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A Novel Air Compressor.

We are enabled to illustrate a decidedly novel and ingenious air compressor lately brought out by the New York Air Brake Co. The peculiarity of this compressor is in the means provided for equalizing and applying the decreasing pressure upon the steam piston during its working stroke to the increasing resistance encountered by the air piston in the work of compression. As is well known, in the direct-acting air compressor, where the steam piston and the air-compressing piston are practically upon the same rod and move together, the steam pressure at the beginning of the stroke is much greater than the resistance against the air piston, and this steam pressure continuing uniform until the cut-off occurs constantly decreases for all the rest of the stroke, while the resistance against the air piston increases as the piston advances until the desired delivery pressure is reached, and continues high for the remainder of the stroke. To compensate for the excess of steam pressure at the beginning of the stroke, and its deficiency at the latter part, it has been customary to depend upon heavy fly wheels and reciprocating parts to equalize the work, and even with these the rotation of the engine shaft is very irregular. By the aid of the devices employed in the present compressor it is possible to dispense with the heavy fly-wheels and other parts, and still to maintain a very uniform rotation, with other advantages that will appear in the course of the description. Fig. 1 is a general view of one of these compressors taken under rather unfavorable conditions. Fig. 2 is a vertical section showing the general arrangement of all the essential parts. Fig. 3 is a diagram showing the movement of one air piston relatively to that of the steam piston at different stages of the stroke. Fig. 4 shows actual indicator diagrams, scale 60, taken from both steam and air cylinders when compressing air to a pressure of 100 pounds, with steam also at 100 pounds, and cutting off at four-tenths of the stroke.

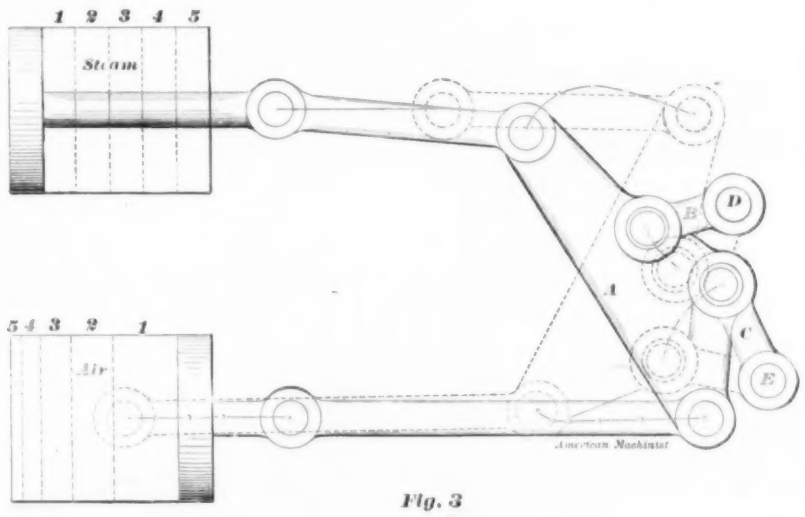


Fig. 3

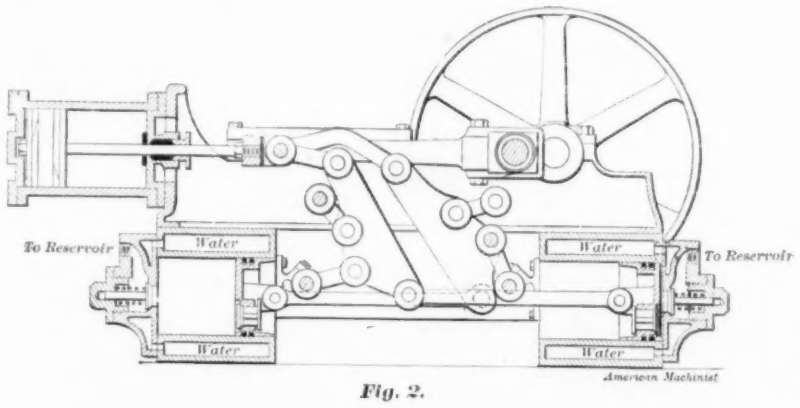


Fig. 2.

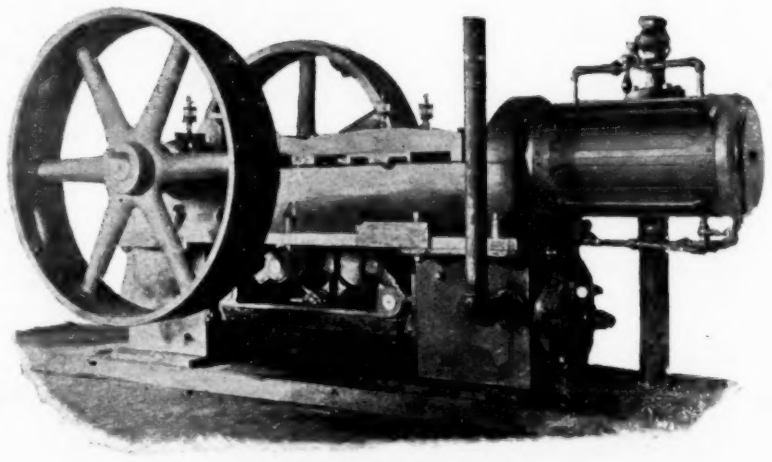


Fig. 1.

AIR COMPRESSOR.

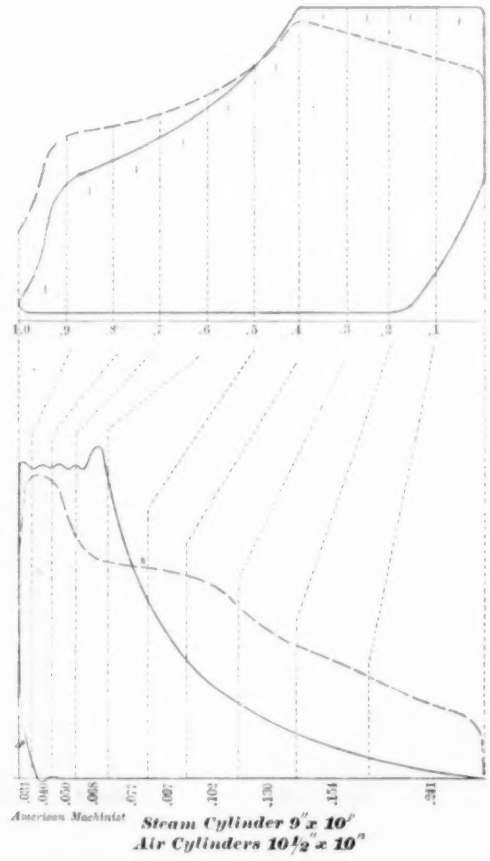


Fig. 4

The air cylinders, as will be seen, are both single-acting, and they together form the foundation for the entire compressor. While they are together equal in free air capacity to a double-acting cylinder of the same diameter and stroke, they are in other respects quite different, as the pistons have movements independent of and always different from each other, except momentarily at a point near the middle of each stroke. The cylinders are completely water-jacketed, and also the entire heads, except where the discharge valves are located. The pistons are of the trunk pattern, requiring no stuffing boxes to the cylinder, and the inlet valves are located in the pistons. These inlet valves have no springs, but alternately open and close by their own momentum with the reversal of the stroke.

Above the air cylinders is placed the steam engine which forms a part of and which actuates the compressor. The engine comprises the usual elements of the horizontal steam engine, the steam cylinder and piston, the crosshead, connecting rod, crank shaft, fly wheels, and the mechanism of the valve motion. Short connecting rods attached to the crosshead give motion to the compensating levers *A*, and through them the power is transmitted to the air-compressing pistons, and with a uniform movement assumed for the crosshead a continually decreasing movement is given to each air piston for its compression stroke. Referring to Fig. 3, and considering now the movement of one air piston only, it will be seen that the lever *A* is connected to the engine bed at two fixed points *D* and *E* by the links *B* and *C*, and that by the movement of these links the virtual fulcrum of the lever in relation to the eyes *G* and *H* is constantly changing. At the beginning of the stroke of the steam cylinder the fulcrum of the lever is above the middle of it, and the air piston will move faster than the steam piston. While the steam piston makes the first one-fifth of its stroke, the air piston makes about two fifths of a stroke. At the latter part of the stroke of the steam piston the fulcrum of the lever *A* is much nearer its lower end, and then the air piston moves slower than the steam piston. While the steam piston makes the last one-fifth of its stroke, the air piston makes the last one-twentieth of its stroke. A similar movement is imparted to the other air piston by its lever and connections. The pistons being each single acting, and slow in movement when the compressed air is the hottest, the water jacket is rendered unusually effective, and the compression curve is kept lower than in most air compressors. The indicator diagrams, Fig. 4, show the practical operation of compression. The upper diagram, from the steam cylinder shows the steam at 100 pounds cut off at four-tenths of the stroke. The dotted line of the diagram shows the effect of the steam pressure for the stroke as modified by the weight of the reciprocating parts. The lower card from the air cylinder exhibits the operation of compressing free air up to and delivering it at 100 pounds. The dotted lines in this diagram show the resultant force as transmitted by the action of the compensating lever to the air piston. It is evident that the work required of the fly wheel in this case is less than in the common stationary engine, while in the common air compressor it is much greater.

Facts for Young Engineers—II.

BY W. H. WAKEMAN.

BOILER STRAINS FROM CHANGES OF TEMPERATURE.

It is well to bear in mind that when a steam boiler is working with the brick walls of its setting in contact with the products of combustion, there is a vast amount of heat present, and it does not all disappear as soon as we draw the fire, therefore if we blow the water and steam out, open the front manhole, insert our hose nozzle and allow a stream of cold water to run along the bottom of the boiler, we cool off this part and cause it to contract, while the sides and top are still expanded by the great heat. This causes a great stress to be brought to bear on the fire sheets, much greater than any ordinary steam pressure would cause, and is therefore to be avoided. If it is necessary to

cool the boiler off within a short time, the steam should be allowed to escape, and when a part of the hot water has run out cold water may be run in, and in this way the temperature will be gradually reduced and less damage result to the boiler. Even this plan is to be adopted only when the time in which to cool off is limited, for it is much better to allow the whole mass to cool by the natural process of circulation of the air through and around it. Some one has told us that to do this in the most effective way, we should take off the manhole and handhole covers on our tubular boilers, shut the furnace and ash pit doors and also the doors in the boiler front and open the rear doors in the setting. This will cause the air to be drawn through the boiler, coming in at the handhole in the rear head and at the top manhole, and going out at the front manhole and thence through the tubes to the stack.

No boiler is stronger than the weakest part of it, so that in estimating the strength that may safely be carried this weakest part must be taken as the basis for the calculation. It may be the riveted seam and it probably is in all new work, but in the case of a second-hand boiler it may be some other part. We wish to call attention, however, to the fact that should a blister appear on a sheet that has not been weakened by corrosion, it is quite possible that it is not necessary to reduce the working pressure, because if the riveted seam has but 60 per cent. of the strength of the solid sheet, and the blister makes the sheet 30 per cent. weaker, it is still stronger than the seam, and we see no reason for reducing the pressure on this account. Of course it will be necessary to ascertain definitely to what extent the blister has penetrated into the iron.

We believe that braces that extend from one head to the other in a boiler, are more efficient than those which extend only from head to shell. When boilers are made very long this is not practical, which is only another argument against long boilers, but with any ordinary length it is easily done. If there is any reason why they should not be put on in this way in any special case, then each brace that is above the tubes should in all cases extend beyond the manhole in the top of the boiler, for this is of necessity a weak spot, and if the braces are put on in this way it strengthens it greatly. There is a decided objection to riveting braces on to the fire sheets, for in that case it brings two thicknesses of iron together, and so increases the liability of the sheet being burned at this point. It is certainly a mistake to go to the expense of making the bottom of a boiler in one piece, in order to avoid riveted seams and then put braces from head to shell on the bottom. We have seen bad leaks where this plan has been adopted, and believe that there is little or nothing to be said in its favor.

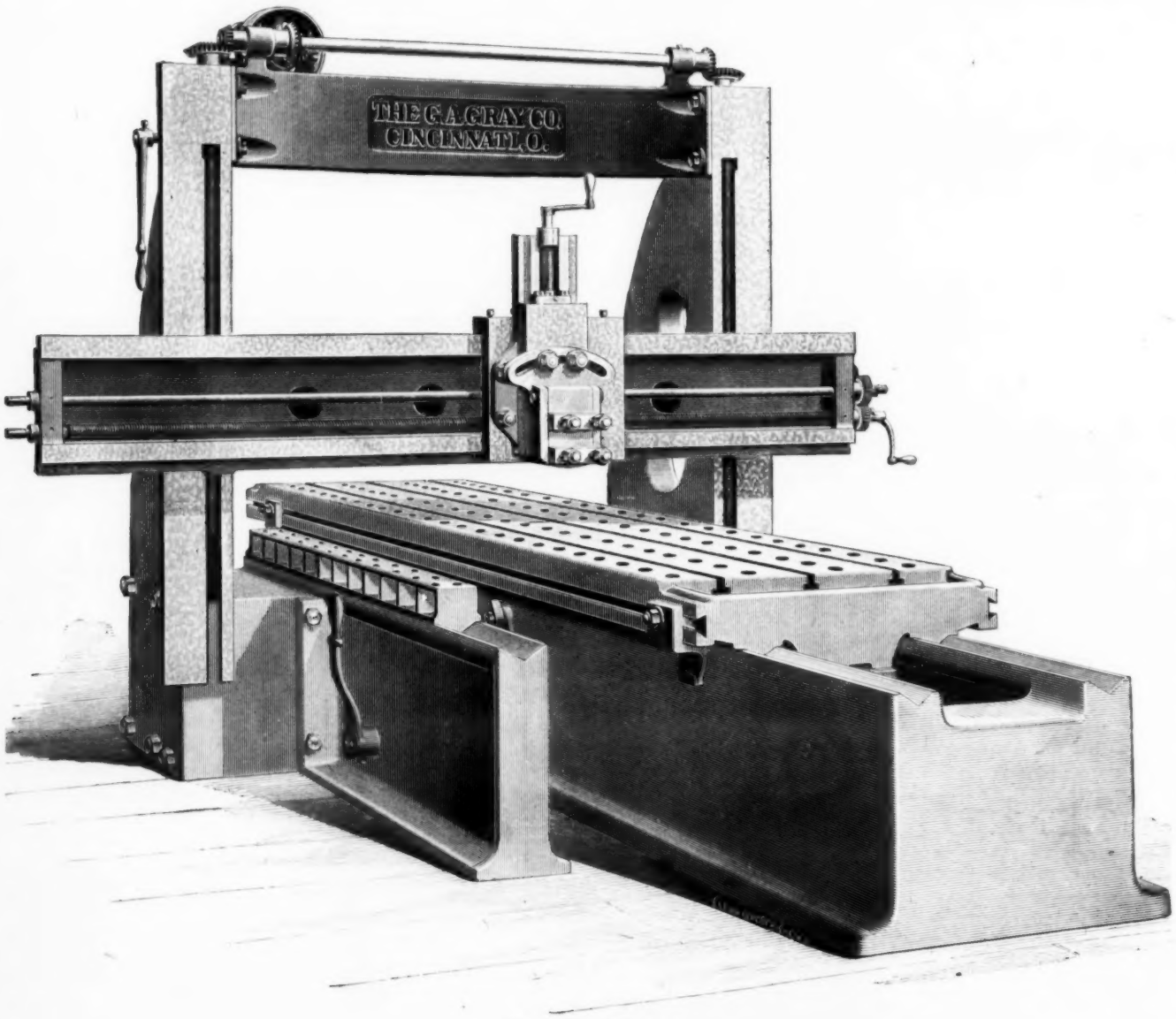
Wherever any part of the blow-off pipe of a steam boiler is exposed to the fire, it should be protected from the direct action of the flame or heated gases, and even if the boiler is fed through the same pipe this precaution should not be neglected. The intense heat may evaporate the water which stands in the pipe when the feed pump is not running, and the pipe will soon become heated and ruined. Sometimes a piece of pipe which is larger than the blow-off is slipped over it when the boiler is set, and this is depended on to afford the necessary protection, but there are two objections to it, the first of which is that it does not afford ample protection, and the second is that it cannot be removed when we wish to inspect the pipe. Sometimes a cast-iron sleeve is made in halves so that it may be put on and taken off at pleasure. This removes the latter objection, but has no effect on the former, for a piece of cast-iron is no better than a piece of wrought-iron, so far as we are informed on the subject, and in either case there is nothing to prevent the heat from entering the space between the pipe and this form of covering and doing harm.

In our practice the most satisfactory arrangement is to cover the pipe with a thick coating of asbestos. This may be bought already ground up for use and kept on hand. When wanted it is easily wet up and applied to the pipe, and can be removed in a very short time when it is necessary to inspect the pipe. It may then be broken up, wet again and used for the same purpose as many times as needed. It should be at least two inches thick, and as it will not stick good when put on so thick all at once, it must be applied in two coats. If there is not time enough for the first coat to dry before the boiler must be fired up, then wind some small loosely twisted rope or strips of rags around it, and apply the second coat as soon as desired. The second coat should also be wound in the same way, and the fire may then be started at once without doing harm.

"Widened Planers."

The accompanying engraving represents a type of widened planers, possessing some novel features, recently brought out by The G. A. Gray Company, of Cincinnati, Ohio.

These machines are intended for use where the work is of unusual width in proportion to its hight, and is not so excessively heavy as to warrant the expense of a regular planer of large size.



WIDENED PLANER.

The usual method of widening planers has been to extend the housings equally on both sides; thereby disturbing the originally handy relation of parts on front side of planer, and interfering with economical operation on such work as ordinarily would not require a widened machine.

These objections are overcome on the machine herewith illustrated, the widening being done by leaving the front side of planer unchanged and merely extending on the opposite side the "cheek piece," to which the rear housing is bolted just the same as on the regular machine.

Ordinarily the widening of planers, especially of the spur-geared type, necessitates a corresponding lengthening of driving shafts and consequently increases their tendency to "spring." The Gray Company overcome this objection by adapting their spiral-geared (Sellers' motion) patterns.

In this type, the driving shafts, being entirely independent of the widening, are in no way affected thereby. It will be noticed that the width of table remains the same as on the regular planer. A special pattern of cross rail is used which in each case is designed to suit the increased span, the box bracing on the back being proportionately increased in its cross section. The cross rail is of such length that when two heads are used either one will traverse the entire width of opening between housings, no matter how much the machine is widened. In cases where the planer has been widened to its extreme width, and where the overhanging work is of such a character as to make an outside support desirable, a supplemental guide and slide are furnished as shown on accompanying cut, which represents a 38-inch by 38-inch planer widened to 60 inches. The intention is to firmly block or wedge up the overhanging work on the supplemental slide and thus practically make a three-track planer, on which work can be planed smooth, accurate and true even at the extreme overhanging side.

The supplemental guide and slide can be made of any length to suit the work, and the cross rail, being supported by rigid, fixed housings at both ends, insures ample rigidity at all points.

The shifter lever being extended through the supplemental guide affords every convenience for controlling the action of the machine from both sides, no matter how much it is widened.

These planers are furnished in all the standard sizes and "widenings," and are supplied with one or two heads on cross rail, and with universal side heads on either one or both housings.

The Position of Corliss as the Improver of the Steam Engine.

We give below some extracts from a letter which lately appeared in the Providence *Journal*. Mr. Smith, the writer of the letter, was for many years connected with the Corliss shops.

. . . "The fact remains and always will remain that to George H. Corliss is solely due the giving to the world a wholly successful embodiment of the combination of the governor with a liberating valve gear. And today the majority of all the stationary steam engines of the world are being built on substantially his exact improvements. Mr. Corliss never claimed that he invented the rotative steam valve, now claimed by William Wright, in a very indefinite way, as his invention. The use of rotative valves was then well-known. Mr. Wright's so-called suggestion to Mr. Corliss had relation to placing the wrist plate (Mr. Corliss' invention) central to the cylinder and the actuating of four rotative valves placed at the four corners of the cylinder. The first Corliss engine (started up in February, 1848) had four flat valves, two in each top and bottom cylinder heads of a beam engine. The next type was a horizontal engine for the Philip Allen Print Works, having flat valves placed at the four corners of the cylinder in relatively the same place as the now existing rotative type valves, also the shop engine of the Corliss works, started in 1849 (a beam engine), had the same type of flat valves used as in the Allen Print Works engine.

The use of the rotative valve was a great hinderment to the introduction of the Corliss engine, and during the years since it has undergone many changes in construction, and had it been an essential element in the engine it might have been the cause of its early death.

Mr. Corliss was the first person to seize on the idea that to successfully, and practically as well, combine a regulator with a liberating valve gear it was essential that the mechanism should be such that the regulator would be wholly unimpeded in its movements except at an instant of time in the stroke of the engine, and not one of the previous attempts had embodied this essential idea.

With reference to the question: Did Mr. Corliss' invention delay the coming of the

compound engine? I say, not at all. In fact, compound engines have been continuously built in Europe since their first invention by Hornblower, in 1781, and have been known under the name of Woolf (1804) engines; but it remained for so great a mind as that of John Elder, of Randolph, Elder & Co., Glasgow, the father of the modern compound, triple and quadruple engine, to demonstrate on steamships the advantage of compounding in a grand way. It is but a few years since that eminent engineers could learnedly argue that steam expanded was as good for economy in a single cylinder as in two or more. The philosophy of the thing could not be grasped, and hence the delay, until indisputable facts convinced. The same inability to comprehend the philosophy of the steam jacket, invented by James Watt, has kept back its use. Technically speaking, the philosophy of compounding lies in the single fact of less cylinder condensation where relatively the same degree of expansion, and consequent cooling of incoming steam, are confined to separate cylinders instead of to one cylinder. For the steam jacket, its value lies in the fact that the water from condensation in the steam jacket space should drip back to the boiler, thus saving the equivalent condensation of an unjacketed cylinder, which would be lost with the exhaust.

While Mr. Corliss did not possess a philosophical mind to an equal degree with James Watt, yet he did in a very broad way grasp the possibilities in the use of steam at high pressures, at high piston speeds, and expanding it from full boiler pressure down to or below atmospheric pressure. When, in 1853, he inaugurated his business method of replacing either whole steam plants, or only the engines proper, or only the cylinders of engines, for the saving of fuel by his engines in periods varying from 2½ to 5 years, then the obtuse world "caught on" to the fact that a prophet had come to stay.

SCOTT A. SMITH.

Providence, June 14, 1895.

A Modern Machine Shop.—II.

BY HORACE L. ARNOLD.

It should be mentioned that this south wall is only temporary, being made of tiling laid between the iron crane and roof-supporting posts, as only the north section of the shops, as shown in Fig. 9, has been erected; this north part, at present used for the main machine floor, will ultimately become the erecting floor. Fig. 10 shows the complete plan and elevation of the entire shops as they will appear when completed. Fig. 11 gives a plan of the gallery, offices, and drafting and pattern room.

The drive in the Gates shops is a mixed system of electric motors and short line shafts. The motors are all alike, of the Gates Company's own build, 20 to 25 horsepower, weight 3,500 pounds each, and cost, including rheostat and automatic switch and cut out, $460 each for labor and material, or $625 "long cost," which is supposed to include all expenses of every kind incident to their construction.

The mixed system of motor and line shaft driving is not nearly so clean and open as the full independent drive lately shown in the illustrations of the Baldwin Locomotive Works wheel floor. Mr. Hanna, the first assistant superintendent of the Gates shops, thinks a motor can be built for less than $60 ample to drive medium machine tools; with a motor at $60, there would seem to be little ground for argument in favor of the short line shafts included in the mixed drive system.

But there is still the question of the countershaft and countershaft cone belt to deal with, and unquestionably in case a mixed drive is used the better place for the line shaft is close to the shop floor, with the countershaft driving belts reaching up from the line shaft, and the cone belts reaching down from the countershafts to the machine cones. In case the low line shaft is to be used it seems hard to avoid an equivalent for the countershaft support and pillars shown in Figs. 2 and 7.

This countershaft support and line shaft can be extended at pleasure, and takes up no room which would be otherwise available for any useful purpose, because the pillars, shown in elevation in Fig. 12, stand between the two rows of lathes, which are set close together, back to back, with no space lost. In the Baldwin wheel lathe individual electric motor drive, the countershafts are carried on flat wrought-iron structures, each made specially to fit the tool driven. While this makes a very light and open affair, there are superintendents who dread the blacksmith shop, and it is quite probable that the mixed drive will continue to be used in machine shop electrical motor installations for some time to come. The views given show the unobtrusiveness of the belting and countershafts in the Gates shops, and the pillar support for the double bank lathe drive is not open to objections on the points of cost or waste of floor space, and while very much in evidence in Figs. 2 and 7 it is barely visible in the middle of Fig. 5, taken from the other end of the shop. In point of fact, the bracket support for the boring-mill countershafts along the south wall is a more noticeable feature in the engravings than the pillar support for the lathe countershafts.

Fig. 6 gives a close view of the 25 horsepower motor driving the low line shaft for the boring mills; the belt from the motor pulley to the line shaft is extremely short, as seen at the left side of the motor, but seems to drive perfectly well. Fig. 6 shows the general exterior appearance of the Gates motor so clearly that no detailed description need be given. The line shaft is close to the wall, so that the large driving pulley is cut into a recess formed in the wall to take it.

The lighting of the shop throughout is extremely good, as the engravings clearly show.

Referring to Fig. 11, plan of the second floor or gallery, the arrangement of the office and drafting room, closets and wash basins will be seen. The drafting room light is most excellent, the windows looking north, and the room being so very narrow that with its walls hard finished in brilliant white, every one of the two rows of drawing stands is perfectly lighted at all times, either by sunlight or the abundant electric lights provided.

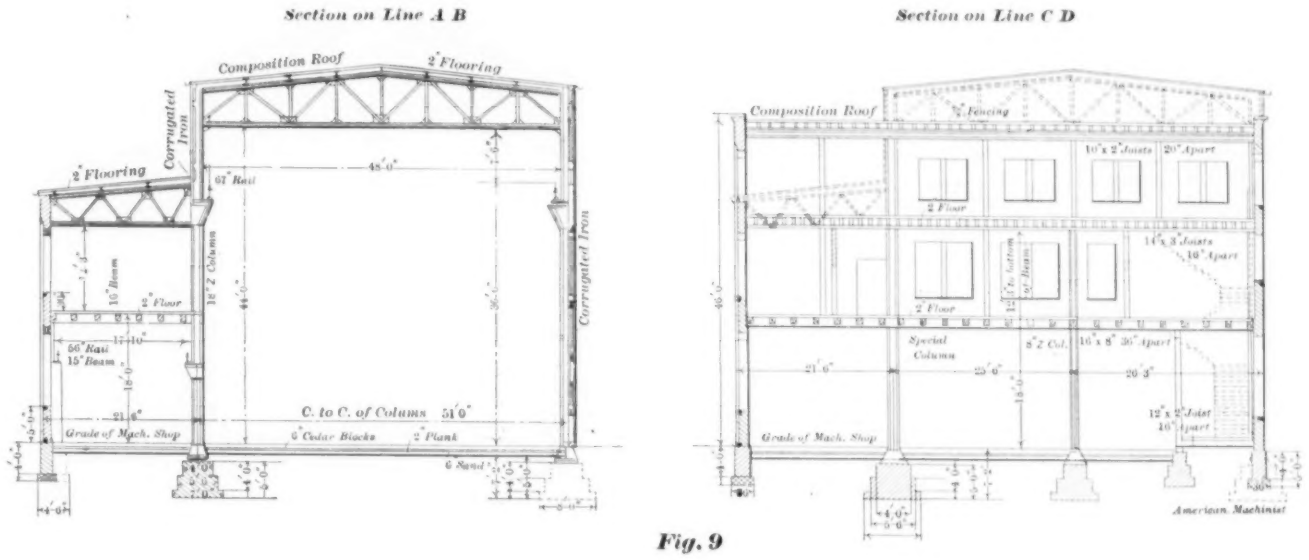


Fig. 9

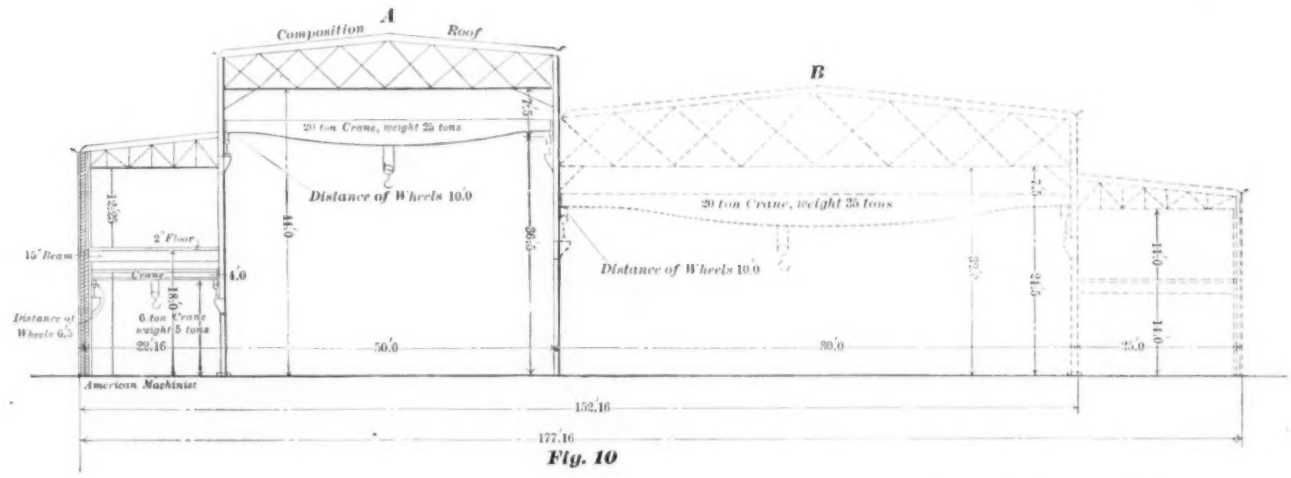


Fig. 10

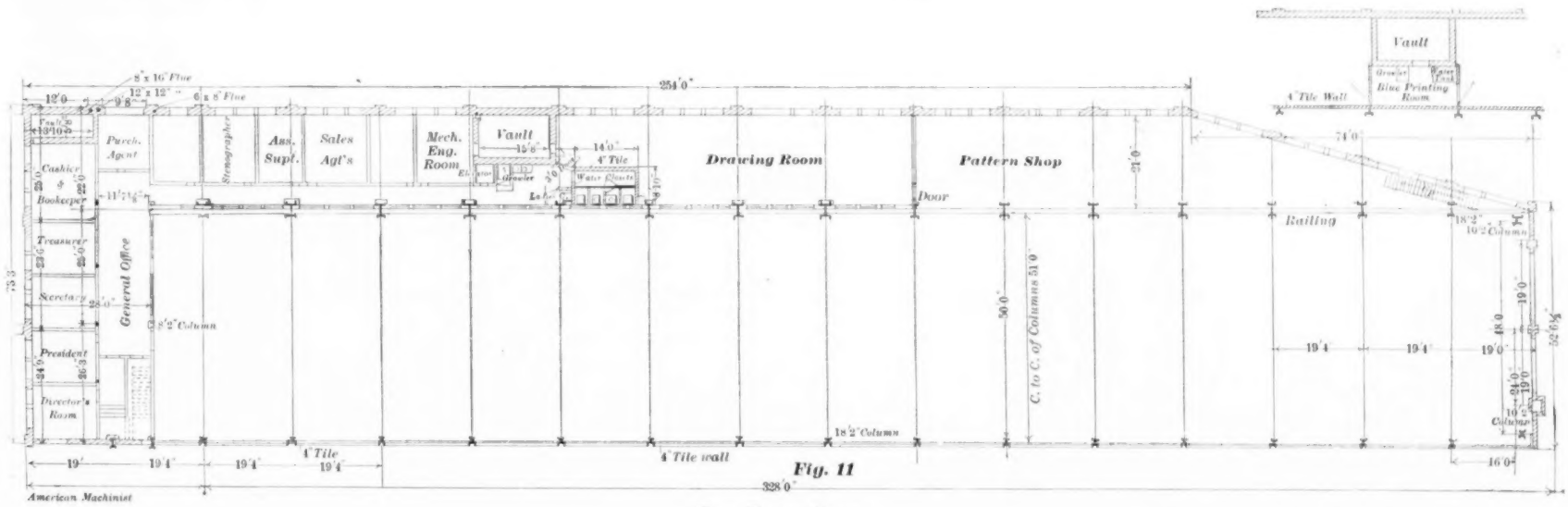


Fig. 11

THE GATES SHOPS.

The drafting room is so admirably conducted by the chief draftsman, Mr. Chas. L. Carman, and contains so many new details of practice that it will be made the subject of a separate paper, and so none of the drafting room or blue print room details need be mentioned here, further than to say that the small square in Fig. 11, immediately to the left of the hand basins at the east end of the north corridor, is not marked "growler" because it has any connection however remote with the procurance or consumption of malt liquors, but because it contains a balanced rack and pinion hand driven elevator carriage, which affords direct and speedy transit from the drafting room to the blue print room on the roof of the side structure overhead. Next to the "growler" is the office elevator, power driven, for ready transportation between the office and

machine floors. Probably no other shop in the United States is arranged to put less useless labor on the office force than this shop. The room marked "Mechanical Engineer," and supposed to be occupied by Mr. Thos. L. Capen (who is well known in the East) is really used by Mr. E. E. Hanna, acting superintendent, who came from the real west of the Pacific coast and Rocky Mountains, and speaks of Chicago as located in the ultimate Orient. Mr. Hanna is thus in immediate reach of the drafting room and of Mr. Capen, who has the next room west but one, and has only to step into the corridor to survey the whole machine floor, or to step to the elevator to make the downward journey to the shop without effort. The offices do not communicate by doors in the partitions, except where the occupants are very intimately connected in their work; and place peculiarly his own, and no one is in any way an intruder on the work or domain of another. This is a feature which seems of great money value, and would certainly afford a vast relief in many large establishments where no privacy or seclusion of any of the members of the office force, from the highest to the lowest, is possible.

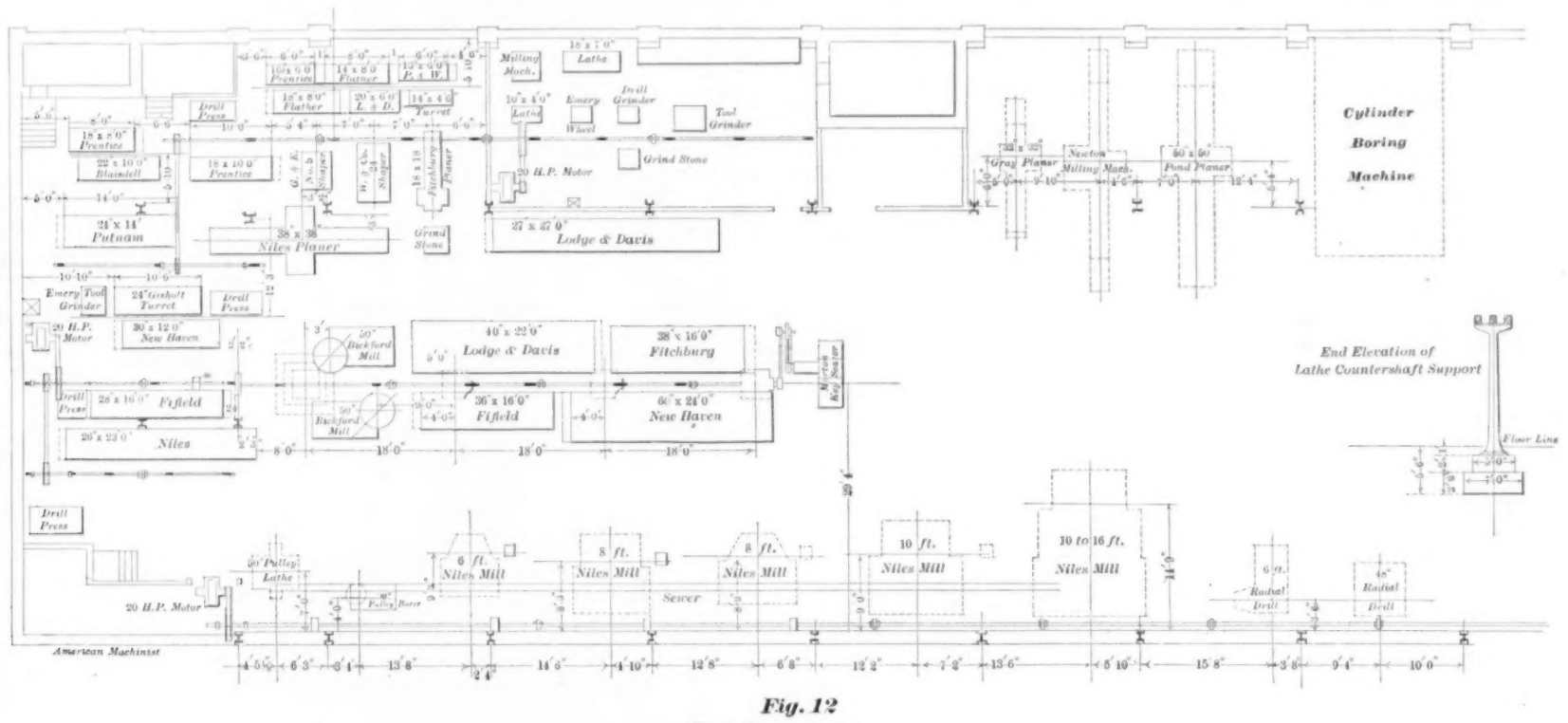


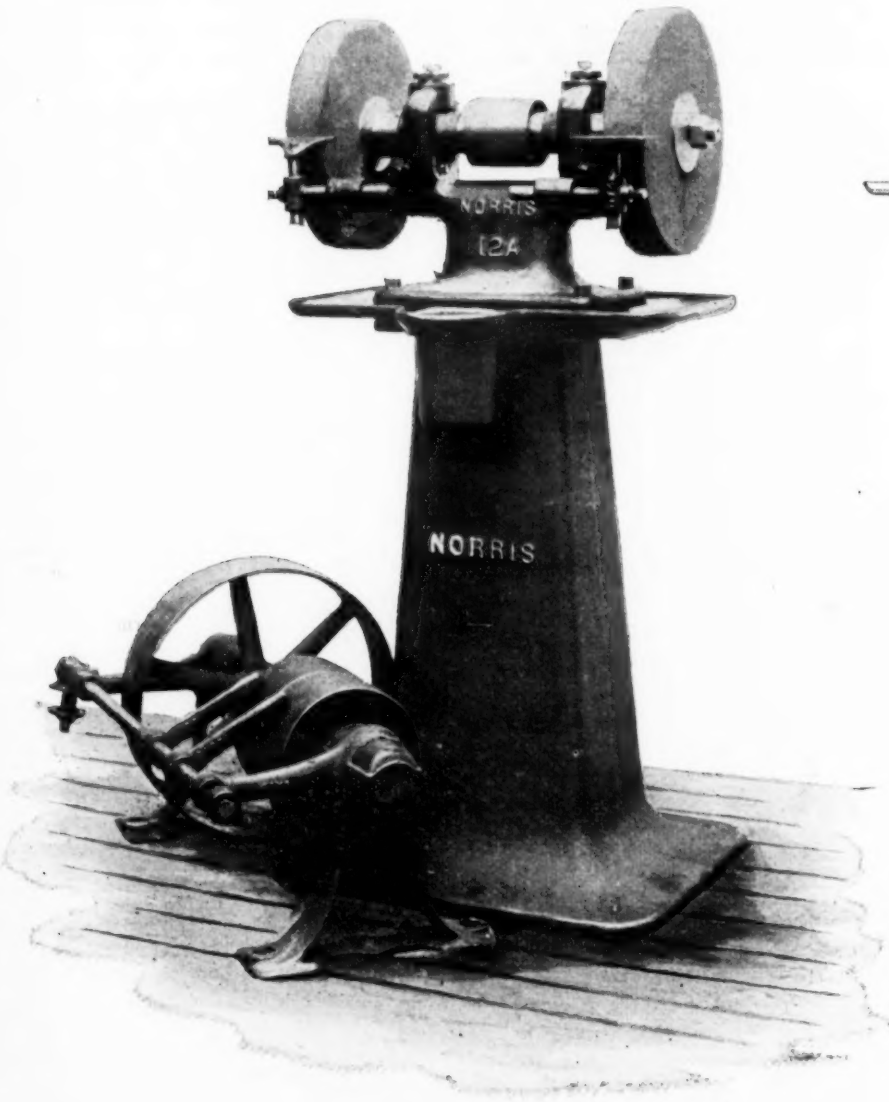
Fig. 12

THE GATES SHOPS.

The west front and north wall of the shops are brickwork, as will be the final south and east walls. The south wall is temporary, as previously stated. Above the second floor, in front, there is a large and well lighted room available for a force of bookkeepers, when needed; or this room might well be utilized as a refectory, should the Gates Company adopt the Philadelphia custom of lunching at a private table on their own premises; the high location serving admirably against the intrusion of the dust which close observers claim to have sometimes noted in the outlying districts of Chicago.

The cost of the Gates shop per square foot of floor surface could not be given, nor could exact figures of gain in power expenditure due to electric driving be obtained.

The Gates works are doing a full double turn of 20 hours per day at present, and see no present prospect of less work, and are certainly to be congratulated on the possession of such admirable shops.



GRINDER.

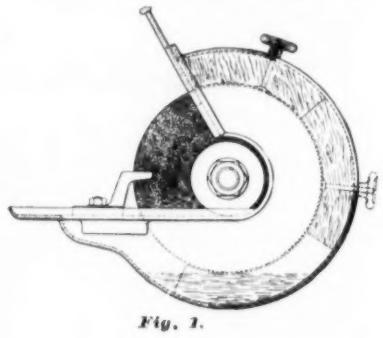


Fig. 1.

A New Emery Grinder.

The accompanying illustrations represent a new line of small grinders adapted to wheels ranging from 8 to 14 inches diameter, and from 1 to 2½ inches face. The machines are designed for either dry or wet grinding, the water attachment, Fig. 1, being made to bolt to the sides of the heads, thus forming convenient and efficient tool grinders.

The spindles are of hammered steel, long and stiff, the length being between shoulders, and not in overhang. The boxes are spherical in form, unusually long, self-aligning, thoroughly dust proof, and provided with convenient means of compensation for wear. The rests are adjustable in all directions, and have great rigidity, the number of joints being reduced to a minimum. The heads are of neat design, have wide spread between bearings, large rectangular bases, and are secured to either bench or column by four screws. The machines are made by the Norris Machine Co., Twenty-ninth and Jefferson streets, Philadelphia.

The best fender for the trolley car is in the brake.

Adjustable Two-Spindle Drill Press.

This machine is designed to meet the wants of those having work where two holes can be drilled at once, and at variable center distances. The spindles are driven by universal joints, are of tool steel ⅞ inch diameter and 6½ inches long in bearing.

They are carried in bearings, which slide on the crosshead, and are moved either toward or away from each other by means of a right and left-hand screw. They can be set to drill holes from 1¼ inches to 12 inches center distances. Present size of machine will carry two $\frac{5}{16}$-inch drills and all sizes smaller.

ADJUSTABLE SPINDLE DRILL PRESS.

The machine complete weighs about 300 pounds, and is built by Foote, Barker & Co., Cleveland, Ohio.

Dangerous Manufacturers.

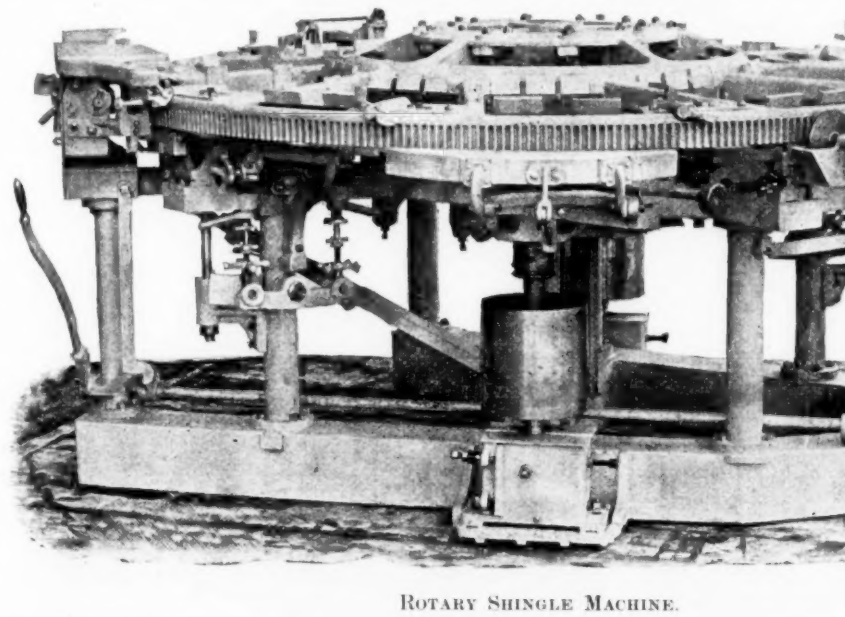
The following occurs in the address of A. E. Edkins, president of the Ontario Association of Stationary Engineers, at the annual meeting of the association, recently

held at Brantford, Ont. Do his remarks apply exclusively to Canadian manufacturers?

There is one other matter which I would like to bring to your notice, and in my estimation it is one of considerable moment to us as steam engineers. I refer to the detestable action of some manufacturers of engineers' brass goods and fittings, who in order to save a few cents worth of metal, are in the habit of coring out the squares of blow-off cocks, and otherwise reducing their strength, until they are positively dangerous to handle or move under steam pressure. Several cases of narrow escapes from scalding of engineers have come to my notice from such causes, and I have here a specimen for you to inspect which will speak for itself, and I think you will all agree with me that any manufacturer of brass goods who would deliberately turn out such trash, especially in these days of constantly increasing pressures, when the tendency should be to increase rather than decrease the strength, is worthy of a place in penitentiary, and I hope this association will pass a resolution severely condemning such perfidy on the part of manufacturers who for the sake of a few cents worth of metal would turn out articles that will endanger our lives while in the discharge of our daily duties.

A Rotary Shingle Machine.

As we lately illustrated and described a reciprocating shingle sawing machine, we now present a rotary machine. The machine consists of a bottom and a top plate, with posts connecting them and forming the frame of the machine, two vertical saw arbors, each carrying a thin shingle saw, and a large revolving table over the saws divided into ten pockets or carriages carrying the shingle blocks or "bolts," and with stationary and movable dogs upon each carriage for holding the blocks. In the view presented the pulley of one of the saw arbors is prominent in the center, while a portion of the pulley of the other saw arbor is seen behind it. A horizontal shaft at the right pointing nearly straight at the spectator, with a large cone pulley upon the farther end of it, by means of the bevel gears and the vertical shaft drives, the table, turning it, as the sawyer faces it, from left to right. Each carriage is provided with a pivotal trip projecting beyond the rim of the wheel, and adapted, at the option of the sawyer, to shift the tilt tables or grainers, or to remove the supporting ways, and allow the spalt, or unsawed remnant of the block, to drop out of the machine, and then to reset the ways for the reception of the next block. The spalt is dropped as the carriage is at the left of and approaching the sawyer, so that he has time to insert another block, and still lose a minimum of time in the sawing. The dropping of the spalt is an important and valuable feature of this machine, as in operating other machines an extra man is employed for taking out the spalt, and with the greatest care it is always a dangerous operation, as well as wasting time. The blocks in the several carriages are not used up and ready to be dropped out in unbroken succession, and this is also provided for. As many as may require to drop out in succession may do so, and when a carriage comes by that is not ready for this operation it is automatically exempted. An oiling wheel to be seen running in a little trough in front of the circular rack towards the right, oils the trips. The table is supported upon a central shaft, and is also steadied by four blocks under the rim in the front and rear of the saws. These blocks are of hard wood standing endwise, each in a trough of oil, and their rubbing surfaces are oiled by capillary attraction. The mechanical devices in this class of machinery are not always or necessarily of the finest. The "feed" shaft, or the shaft which causes the revolution of the table, has a cone pulley upon it with three steps. The line shaft also carries a corresponding cone pulley with three steps, and this pulley is arranged to be slid along upon the shaft so that either of its steps may be brought opposite either step of the pulley upon the machine, thus giving nine different feeds. The adjustment of the belt tension is provided for by hinging the brackets which carry the pulley shaft on the machine, and this arrangement also provides an automatic stop or release for the table in case of accident. The tilt tables are adjusted for butts, points, thickness and lead by independent screws. In reversing the tilt table for the alternate shingles a difficulty occurs, as the tilt table represents a circle, while the shingle bolt travels in a true plane, and it is necessary to automatically shift the "lead" of the tilt as it reverses for butt or point. This is overcome by a wedge or incline at the back of the tilt post, which simultaneously shifts the tilt table both transversely and longitudinally. The arbor boxes, both upper and lower, can be adjusted to or from the center of the machine for different lengths of shingle bolts from 16 to 18 inches. This machine is built by Perkins & Co., Grand Rapids, Mich.

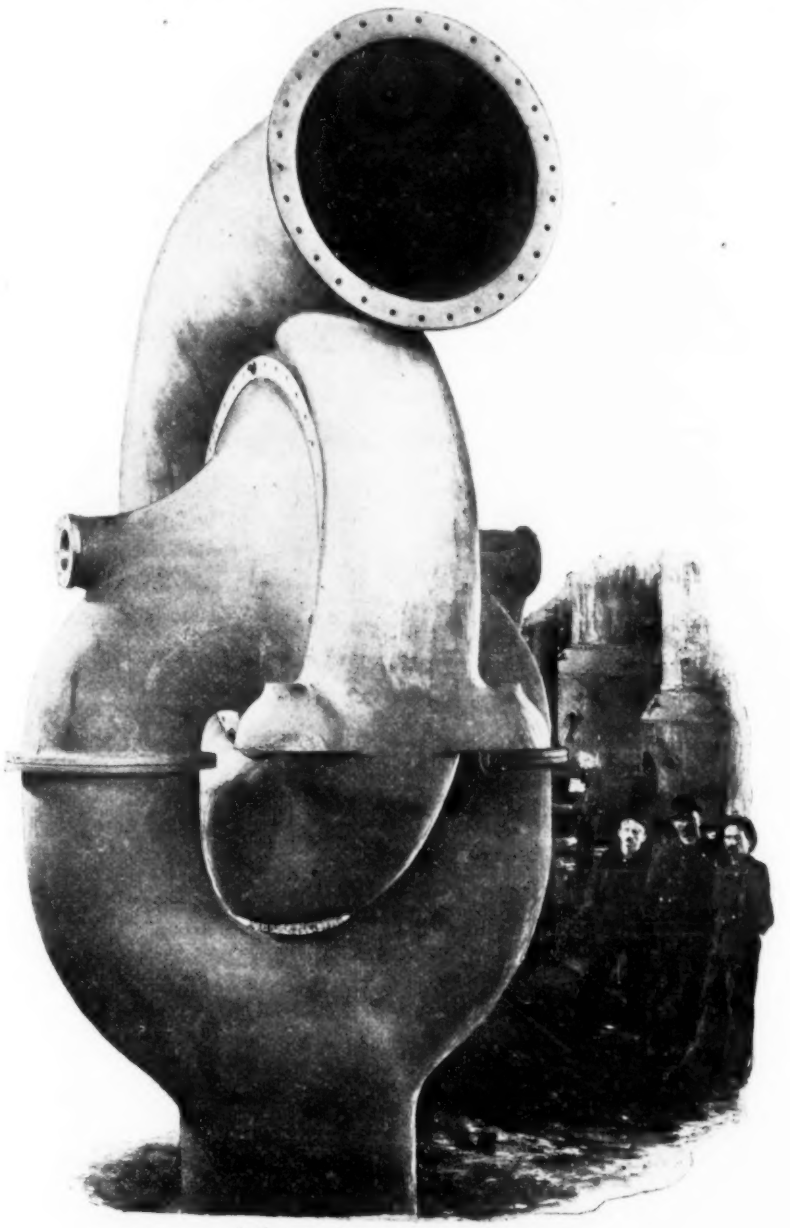


ROTARY SHINGLE MACHINE.

A Large Centrifugal Pump.

We reproduce a photograph of the main castings of one of three 42-inch centrifugal pumps, built by Moran Brothers Company, Seattle, Washington, for the new U. S. Dry Dock, at the Puget Sound Naval Station, Port Orchard, Wash. This dry dock is said to be the largest in this country, and is to be completed September 1st of this year. The machinery equipment for these dry docks was designed by the builders, and approved by the navy department.

The three pumps are alike, the dimension, 42 inches, being the diameter of the suction and discharge pipes. The photo was taken in the foundry where the castings were made. It will be seen that the entire main body of the pump was cast in a single piece. It was made in loam, and swept up without patterns, except for the supporting lugs and the flange at the discharge. The plan of making insured an accurately fitting core, and consequently an even thickness of metal, the importance of which all will appreciate. The Y suction pipe was also swept up in loam, and the heads were made from a pattern parted to leave its own core.



A LARGE CENTRIFUGAL PUMP.

The three pumps are duplicates, and each is driven by a vertical inverted cylinder, direct-acting steam engine, 28 inches by 24 inches stroke, the engines having piston valves and "Meyer" variable cut-offs. Each pump and its engine stand upon a common bed plate, the engine connecting directly to the pump shaft. The three pumps, with steam at 100 pounds at the boilers, are to have a mean discharge duty, collectively, of 110,000 gallons per minute, measured while pumping from mean high water to the still level. The wheel of each pump is about 68 inches diameter mounted upon a hammered steel shaft running in bearings lined with bronze, and with bronze stuffing-box glands. Each pump has a steam ejector for exhausting the suction and charging the pump. It has also two double-gate valves, one for the suction and the other for the discharge. The gate on the discharge pipe is operated by a steam cylinder controlled by a hydraulic cylinder, so that it can be opened or closed as rapidly as may be desired by operating valves placed near the main engines. The suction valve is worked by hand. Each gate valve is provided with a starting screw.

The shafts of the engines are of hammered iron forged solid, with cranks and counterbalances. The pistons are cast of steel. The piston rods of forged steel are required to be so secured as to prevent turning both in the pistons and crossheads. The crossheads are of steel, and the guides of white metal. The connecting rods are of forged steel, and the eccentric straps of brass.

The steam will be supplied by six cylindrical horizontal return tubular boilers 6 feet diameter by 16 feet long, with 80 4-inch tubes to each. The specifications require the plates to have an ultimate tensile strength of 53,000 to 58,000 pounds per square inch, an elongation of 23 per cent. in 8 inches, and a reduction of area of 50 per cent. at fracture. The boilers are to be tested at 180 pounds by water pressure. There is to be one feed pump and feed-water heater, and one injector for emergencies. It will be seen that the above constitutes quite an interesting plant, and we hope that before long our readers will be able to know a little more concerning it.

Machinery Trade With Germany.

To export successfully to foreign countries it is necessary that the existing tariff laws and general requirements and demands of such countries should be clearly understood. To this end reports are being received from the countries to which the principal exports are to be made, and among others Germany is one of the most important.

The commerce of the German Empire is carried on under special laws and rules, emanating from the Zollverein or customs union, which, since 1888, embraces practically the whole of the States of Germany and the Grand Duchy of Luxemburg, all of which are designed for the maintenance of a common tariff or uniform rates of duty on imports from other countries, and free trade among themselves.

During the six years ending December 31, 1893, the foreign commerce of Germany increased 8.7 per cent., while that of Great Britain increased only one-tenth of one per cent.; as compared with a decrease of 3.6 per cent. in that of France, and an increase of 3.3 per cent. in that of the United States for the same period.

In considering the commerce of the German Empire mention should be made of the North and Baltic Sea Ship Canal which was constructed by the German Government at a cost of $39,000,000, and was recently opened for use. A saving of from 97 to 490 miles will be effected in distance, and of 3 to 45 hours' time between the different parts of the North Sea and the Baltic, and it is expected that this will exert an important influence upon the Baltic trade, as well as upon the naval development of the Empire.

The first uniform tariff law affecting imports to the whole of the German Empire was enacted on October 1, 1870; this was afterwards amended by a later Act of July 7, 1873, and was distinctly a tariff for revenue, without any avowed protective purpose. This was superseded by the tariff act of July, 1877, which revolutionized the fiscal policy of the German Empire by the abolishment of the free trade and revenue tariff system, which had prevailed up to that time, and established in their place protective duties upon a long list of articles of general commerce and production. This Act in turn was amended on May 22, 1885, and again on December 21, 1887, both amendments being advances in the duties under certain schedules. The Act of 1879, as thus amended, is the protective tariff of Germany as it exists to-day, and it is essentially a system of specific duties. Under this Act we have to enter all goods exported to that nation.

The German customs duties on agricultural machinery are rated according to the preponderating material, and are classified in four divisions:

(*a*) Of wood at $0.714 per 100 kilograms (or 220.462 pounds).

(*b*) Of cast-iron at $0.714.

(*c*) Of wrought-iron at $1.19.

(*d*) Of other common metals at $1.904.

The exports of agricultural implements from the United States to Germany for the year ending June 30, 1892, were valued at $292,020, which was divided as follows: Mowers and reapers and parts of same, $222,261; plows and cultivators and parts of same, $2,261; and of all other machinery $67,498.

In 1893 there were exported to Germany, mowers, reapers and parts of same to the value of $301,136; plows and cultivators and parts of same, $1,056; and of all others $75,543, making a total of $377,735.

In 1894 the value of the exports of mowers and reapers and parts of same was $386,096; that of plows and cultivators and parts of same, $3,874; and of all others $134,746, or a total for the year of $524,716.

This will clearly show that all that is wanted to increase our trade with Germany is some of the good judgment, good advertising, good goods, and push that we know so well how to use in our own country.

Washington, D. C. A. F. TENNILLE.

A New Sensitizing Brush.

In many manufacturing establishments it is preferred to sensitize the paper for blue printing on the premises. This is usually accomplished by applying the fluid to the surface of the paper by means of an ordinary sponge, the objection to this is the soiling of hands, and the labor required in applying the fluid evenly within the limited time in which this must be done. To overcome these objections Mr. Edward A. Osse, Baltimore, Md. (P. O. Box 493) has recently brought out a new sensitizing brush, of which we give an illustration. It consists of two wooden sides about 10 inches long and 2 inches deep, these sides are hinged at each end near the bottom as indicated at the right-hand end of the illustration; these hinges keep the sides sufficiently far apart for the insertion of a piece of felt which is folded to the form of a loop, and extends throughout the whole length of the sides, and is attached to them. The edges at the ends and top of sides are united by a rubber cloth, the joints between the wood and rubber are air tight; the rubber also serves to keep the sides apart at a greater distance at the top than at the bottom, so that a section of the brush has a V form.

The operation is as follows: The felt is dipped into the fluid, and the inclosed space between the sides is charged by first compressing the sides, and then relaxing the pressure which causes an inward flow of the

SENSITIZING BRUSH.

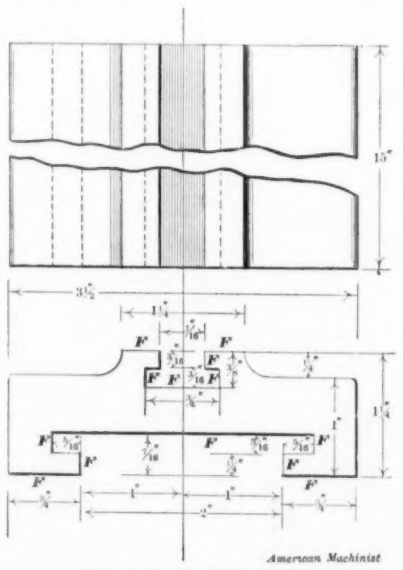
fluid through the felt; the brush being charged, the felt is drawn over the surface of the paper. By compressing the sides the fluid is fed to the paper, which, in this manner, can be quickly coated, and insure an even and uniform spreading of the solution.

LETTERS FROM PRACTICAL MEN.

Figures on Drawings.

Editor American Machinist:

Enclosed I send you a drawing whose horizontal indicating and vertical indicating lines are figured to read alike (from before you) in both cases. In the ordinary method the vertical lines are figured at an angle of 90 degrees to those of a horizontal direction. Now this method of figuring drawings saves the draftsman and shopman considerable unnecessary twisting of the ball joint in the neck, and becomes a ready method of simplicity, and involves no loss at all to the correct conveying of sizes to the workmen. After years of unnecessary turning the head one-quarter way around in order to read dimension figures, I became convinced that in most cases I could do better, so I have figured my drawings for some years this way. I am not writing this method up to help out the experts who can do most anything easier than easy, but for the men who do the work in drawing room and in the shop. Experts can read figures



FIGURES ON DRAWINGS.

upside down or at any angle, without setting their heads on a bias, so they say, but ordinary men (first-class ordinary at that) need to have all mechanical problems (especially new to them) placed in the most intelligent shape.

The figure represents an ordinary square-tongue slide having a T-groove on top side, 15 inches long, 3½ wide, 1¼ thick; the letter *F* designates what parts are to be finished, so that the patternmaker can make the pattern, and allow for finish, and the machinist can do the machine work from the same drawing, and alike read measurements from before them without trouble, and with less liability to read wrong, as from a bias twisting glance, as on ordinary drawings. The ordinary method reminds one of some proficient letter writers, who having filled all of the horizontal space on their paper, extend their manipulations on the vertical borders of letter, encroaching "on to" the regular line writing, and before they finish they get around on top of sheet, sometimes bottom side up, sometimes right side up, until the receiver is often puzzled as to where to begin, how to read, and when he is done.

The argument is sometimes offered that all figures should read from the same direction of sight as the indicating points designate; that is simply an argument; while the opposite simply replies that any dimension line having two terminating points, with an opening in the midway of said line to receive figure, is equally intelligent, whether figure is one way or another, and more readily made in the drawing room, and read in the shop in the method illustrated.

Some years ago a venerable patternmaker objected to my method, and argued to me that there was a greater liability to mistakes, etc., etc., in reading. I tried to show him the greater liability existed in the received method; he said he could read a drawing with measurement figures placed for vertical lines as per ordinary method without inclining his head at all, but, Mr. Editor, he had swiveled his head so many times that he did not observe that when at work he got it around 45 degrees; perhaps he had got that amount of lost motion in his neck joint. But I kept on making drawings, all the same, the same way, and he kept making patterns from them, and you would be surprised how well he liked it after a little while. That man was in a rut on figuring drawings; but later he stood up erect, and looked directly in front of him, and read my drawings the same as he would read any other production of printing. There is a fitness and correctness and ease in conveying properly all intelligence, and the more natural it can be read and understood the more mechanical will it also be.

FRANCIS W. CLOUGH.

Force for Moving a Body.

Editor American Machinist:

In your issue of June 6th, you give an answer to "J. W. D.," Brooklyn, N. Y., which does not appear to me to be the correct one. The problem is illustrated in Fig. 1, in which *A* is a crank pin working in a yoke and revolving about the center *B*. The question is: What force will be required to move the yoke, which weighs 2,000 pounds, from *A* to *B*, when the crank moves at a uniform velocity of 90 revolutions per minute? Your answer is given on the assumption that a uniform force be applied that will give the weight a velocity equal to that of the crank pin in a space of 7½ inches.

If I fully understand the matter, the uniform speed of the crank pin causes the accelerating force to be a variable quantity, which is properly illustrated by what is known as the "inertia diagram," and that the initial force is calculated by the formula for centrifugal force, which is:

$$F = \frac{W R n^2}{2{,}933.54};$$

in which F = the force, W = the weight, R = the radius of crank in feet, and n = the revolutions of the crank per minute.

Substituting the values into this formula, we have:

$$F = \frac{2{,}000 \times .625 \times 90 \times 90}{2{,}933.54}$$

$$= 3{,}451.5 \text{ pounds},$$

which is the initial force in starting the yoke from a state of rest at *A* by means of a crank movement. The complete diagram for this case is illustrated in Fig. 2. The accelerating force at any part of the stroke is measured by the vertical distance between the horizontal line *A B* and the diagonal *C D*.

C. L. REDFIELD.

Thin Wrought Pipe in the Market.

Editor American Machinist:

Recently in writing up a specification for some piping it called for pipe of full standard thickness, and one of the parties bidding objected to this on the ground that merchantable pipe now on the market was 10 per cent. less than this, and an extra charge would have to be made if the standard pipe was put in. This was from a pipe fitter that knew that the pipe would be thoroughly inspected, and that it would be the wiser course to have all these questions settled beforehand.

On looking up the matter this proved to be the case, and the question arises, do

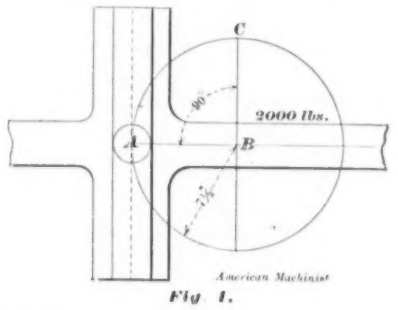


Fig. 1.

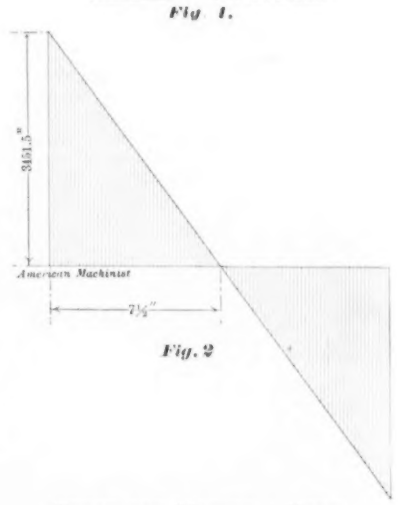


Fig. 2

FORCE FOR MOVING A BODY.

designers know this fact, and allow this cheaper pipe to pass, so that it has become a standard?

The constant tendency is towards higher pressures, and while there is not much deterioration in steam pipe, there is more or less in water pipe, and in all pipe exposed to high temperatures there must be considerable strain from expansion and a liability to break at couplings and fittings where the thread cuts nearly through the pipe.

In view of this, is it wise to allow the standard to be reduced?

In conversation with a maker of pipe, this matter was brought up, and he claimed that the maker was helpless, as the pipe was ordered of a certain weight, and they had to make what was ordered. That it came about in this way: Contractors in submitting bids always tried to get lower than others, and when they were awarded the contract, bought such material as would give them a profit on the job, and ordered stock accordingly.

Another thing, when a firm doing its own work got a new purchasing agent, this agent thought he had to make a better record than his predecessor, and bought goods where he could get them cheapest, and among other things thin pipe. For a time this showed all right, but later the accounts of the repair department went up, but rarely was the blame put at the right place.

It seems that this subject is important

enough, so that mechanical engineers should in all cases demand that pipe should be of full standard thickness.

It would appear from observation that this new standard was trying to be made by contracting pipers. It can eventually be of no value to them, as the consumer pays the bills, and the cheaper pipe cannot give the satisfaction that first-class pipe will.

It also seems that the maker's name on the pipe is not proof that it is standard, and the only way to know definitely is to cut off a foot, not threaded, and weigh it, and then steel pipe will overweigh.

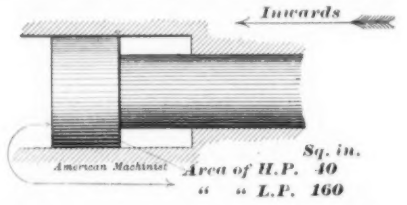
Another thing that was once attempted on the writer, was to go by the outside diameter of pipe, and 13 inches was supplied where 14 inches was called for, claiming that above 12 inches pipe was known from outside diameter. This did not work, but I have heard of two or three cases where this had been tried. W. E. CRANE.

Waterbury, Conn.

The Thornely Hybrid Compound.

Editor American Machinist:

In your issue for May 30th you give a sketch and make some remarks concerning the above rather uncommon engine. The subject is an interesting one to me, for many years ago I had occasion to design a vertical steam pump, in which a somewhat similar hybridism was adopted. However, the object of this letter is to call your attention to an evident confusion of thought in the treatment of your solutions. Obviously, and as you may readily see by referring to your figures, the confusion must



have been brought about by using rough estimates, for the figures in your first calculation are not at all reconcilable with those in the second. Failing to bring about harmony with those you give, I venture to submit the figures given below (of course any figures will do for purposes of illustration, but they must be relatively correct), and then, based on these, offer two or three methods for computing the desired horse-power.

	lbs. per sq. in.
Average steam pressure in H. P. cylinder	= 58.
" back " " " "	= 18.
" steam " " L. P. "	= 17.
" back " " " "	= 2.5

A.—Conceive static loads equivalent to the average pressures; consequently, for the inward stroke (see sketch) we shall have 58 pounds per square inch on 40 square inches, opposed by 2.5 pounds per square inch on 160 square inches, or by figures $58 \times 40 - 2.5 \times 160$ = a resultant of 1,920 pounds, and for the outward stroke 17 pounds per square inch on 160 square inches, opposed by 18 pounds per square inch on 40 square inches, or by figures $17 \times 160 - 18 \times 40$ = a resultant of 2,000 pounds. We may now conceive these resultants to move in accordance with the given piston speed of 250 feet per minute, but inasmuch as each only operates through half a complete stroke the available motion is only equal to 125 feet per minute, and the horse-power will be found to be equal to 7.2727 for the H. P., and 7.5757 for the L. P., or a total of 14.8484 horse-power.

B.—Consider the total work done; this involves the average steam load in the direction of useful work, and the average back pressure in opposition to this. The average steam load is that due to the mean of 58 pounds per square inch on 40 square inches and 17 pounds per square inch on 160 square inches, or 2,520 pounds, and the average back pressure load is that due to the mean of 18 pounds per square inch on 40 square inches, and 2.5 pounds per square inch on 160 square inches, or 560 pounds. Deducting this last result from the previous one, 2,520 — 560, and the effective resultant is 1,960 pounds, which at 250 feet per minute, will develop 14.8484 horse-power, similar to that found above.

C.—Referring directly to the diagrams: These, of course, show distinctly the process of steam distribution, and serve as a means to find the various pressures, but in order to find the M. E. P. we must engage in some little calculation. You clearly recognized this, and in order to find the M. E. P. for the high-pressure end of the work, we must consider the conditions given in the first solution *A*, and deducting the total pressure due to 2½ pounds per square inch on 160 square inches from the total pressure due to 58 pounds per square inch on 40 square inches, we shall get a load of 1,920 pounds, which is equal to a M. E. P. of 48 pounds per square inch on 40 square inches, and this 48 pounds is the M. E. P. for the high-pressure cylinder, and at 125 feet per minute ($^{5}/_{8}$) will develop 7.2727 horse-power. Similarly the M. E. P. for the low-pressure end when doing work will be found by deducting 18×40 from 17×160, which gives the total effective load on the L. P. piston, and this divided by 160 gives the required M. E. P. = 12.5 pounds per square inch, and which at 125 feet per minute will develop 7.5757 horse-power. The sum of the high and the low results being 14.8484 horse-power; all agreeing with the previous calculations.

I trust this will at least serve to make clear the conditions in this rather unusual engine problem, and that it will remove the necessity for any process of "skipping over," such as you allude to in your summing up.

You also comment on the heavy friction load consequent on such a design; this is very clearly true, and yet in favor of such an engine is the absence of the three customary piston rod stuffing boxes; and this will somewhat offset the evil brought about by the use of the "trunk." One positive source of an appreciable loss will be that due to cylinder condensation and re-evaporation, "that insidious and insatiate consumer of steam," as someone has grandiloquently expressed it. G. W. SCOTT.

Ravenswood, Ill.

[Mr. Scott's method of computing the power developed in the hybrid engine is perfectly correct and very clearly put, and we take pleasure in reproducing it for the benefit of our readers. Mr. Scott, however, seems to ignore, or perhaps he did not understand, the direction from which we approached the question. We did not set out to show the right way, as perhaps we should first have done, so much as to correct a wrong way of doing it. Mr. Thornely said that there had been some difference of opinion as to the proper mode of figuring the power, and as we had actually, and but recently, encountered a case where it was done in the erroneous way that we used, we thought it probable that the same practice had caused trouble elsewhere, and so we started with that. In our first computation, we simply took for each alternate working stroke of the engine the actual inclosed area of the diagram for that end of the cylinder, and computed the I. H. P. for that end of the cylinder from it and the sum of these for the two strokes gave the total I. H. P. of the engine. But while the total horse-power ascertained in this way is correct, and while it is really more easily computed than by the correct process adopted by Mr. Scott, it does not show the actual apportionment of the power to the alternate strokes, and this we proceeded to show in the succeeding computation by practically transferring the back pressures from one stroke to the other. It is as if in the first operation we had for the inward stroke taken Mr. Scott's figures like this: $(58 - 18) \times 40 = 1{,}600$ pounds, and for the outward stroke $(17 - 2.5) \times 160 = 2{,}320$, and $1{,}600 + 2{,}320 = 3{,}920$, or the same total of static pressure as in Mr. Scott's computation, and of course the same total I. H. P. would result: $3{,}920 \times 125 \div 33{,}000 = 14.8484$ I. H. P. To correct the apportionment of the work to the two strokes, we get by our former process with Mr. Scott's figures $1{,}600 + (18 \times 40) - (160 \times 2.5) = 1{,}920$, and $2{,}320 - (18 \times 40) + (160 \times 2.5) = 2{,}000$, both these results being identical with Mr. Scott's results. If, with this explanation, Mr. Scott wishes to reiterate that "the figures in our first calculation are not at all reconcilable with those in our second," we will try to effect the desired reconciliation. —ED.]

An Indicator Movement for the Ends of the Engine Stroke.

Editor American Machinist:

While reading your comment on *The Engineer's* article regarding the present "Ignorance of the Steam Engine," the thought occurred to me: Why not take cards from the ordinary slide-valve engine, with the indicator drum deriving motion from the valve stem instead of from the crosshead?

Of course this would be valuable only in so far as it would give greater drum travel at those points of the stroke where cylinder pressures change most rapidly, and would be more easily read in throttling engines with fixed cut-off than in those with flywheel governors.

In a great many engines no reducing motion would be necessary, and so far as I can see, there would be no insuperable difficulty in interpreting such a card, even by the ordinary engineer.

The idea may be an old and abandoned one, but I have never seen a card, actual or printed, which was taken in this way. It would seem to me to be well worth the slight trouble it would cost to get a few such cards, if only for "puzzle cards."

NOVICE.

Cast Crank Shafts.

Editor American Machinist:

The article entitled "The Evolution of a Crank Disk and Shaft," page 470, June 13, 1895, recalls to my mind what evidently was never known by the said manufacturers and the writer of said article, although sufficiently published and exhibited to be considered as public knowledge, viz.: that, in fact, Wm. Emcory Mills, of the New York Engine Co., built engines with shaft, balanced crank disk, crank pin and eccentric, a single casting of cast-iron.

They were of the side-crank type, of large diameter and short journals, and sand cored entirely through shaft, disk and pin, and were found to be stronger than solid.

This was prior to successful steel castings, although Mr. Mills contemplated using steel castings, if steel should be sufficiently perfected for the purpose.

About 50 agricultural engines were built with these shafts, which received the usual treatment of unskilled management, runaways, tip overs, rolling down 20 feet embankment, striking bridge abutments, etc., breaking fly wheels and other parts, but never a shaft broken, worn out, defective or unsatisfactory in any way, the working qualities proving superior to wrought-iron.

Some of these engines were finished by the Fishkill Corliss Engine Co., and one was in the New York State agricultural engine test in 1877, taking first prize for power and economy over all, including the engine which took the Centennial prize.

These engines were run with 120 pounds steam and at 325 revolutions. They had piston valves, automatic by varying valve travel, but fixed eccentric.

Mr. Duning, of Geneva Central Iron Works, made some engines with cast shaft and disk but inserted pins.

It follows, therefore, that no fear need be entertained of the success of cast-iron shafts without steel core (which probably lays loose in a chilled hole) excepting the "evolution."

Buffalo, N. Y. F. R. WILLIAMS.

Chain Lubricators.

Editor American Machinist:

The predilection for chain and ring oilers just now is leading to various difficulties, and amounts to a "fad," which probably will be looked back upon as an instance of mild insanity. When rings or chains are employed with slow turning shafts they serve their purpose tolerably well, if the shaft is not very large so that they are not too far apart for distribution of the oil over the intervening surface. But when, as has been the case in recent years, they have been applied to large and quick-revolution shafts it has generally been found necessary to supplement them with other lubricators or run the risk of hot boxes. The reason is not far to seek. Oil will not be distributed laterally over the bearing beyond a certain limited distance from the point of supply, and this distance probably varies with the size and speed of the shaft. The efficiency of the chain or ring decreases as the speed is increased by the action of centrifugal force, which in the first place tends to neutralize traction and increase the slip of the ring or chain, and in the second place prevents the oil from leaving the chain or ring to flow to the shaft. The first of these tendencies to a small extent neutralizes the second, but to such a small extent that it may be disregarded. When the speed becomes more than moderate, the action of centrifugal force interferes materially with the lubrication, and long before it attains a speed not at all uncommon, the greater part of the oil will be bodily thrown off against the cap, whence it drains back into the oil pot without reaching the bearing at all.

It has also been found that a chain of light weight though capable of carrying abundance of oil, was yet possessed of so little momentum that the slightest obstruction would arrest its motion. To obviate this, resort has been had to heavy chains which carry so much oil that the ordinary oil pot would be quickly drained. This suggests larger oil pots, until now regular sprocket chains, heavy as bicycle chains or heavier, are employed, carrying a stream of oil large as one's finger, and requiring an oil pot holding two or three quarts of oil, and yet the bearings do not run cool.

The worst feature about this kind of pump lubrication is the constant churning of the oil in the oil pot, and the impossibility of getting rid by precipitation of the worn out oil and the worn away metal carried away from the bearing. Every particle of oil which has passed between the shaft and the box lining, carried some of the latter away with it, and this ought to settle as silt or mud in the bottom of the oil pot. The chain effectually prevents that, and continually carries up muddy oil instead of clear oil.

The unduly large oil pots, and the inefficiency of the chain as a lubricator, coupled with impure condition of the oil carried, show that the present partiality of engineers for chain oilers is a fad which will not endure for long. R. D. O. SMITH.

Weight and Mass.

Editor American Machinist:

I want to acknowledge my appreciation of the efforts of some of your correspondents to further enlighten some of us "misty minded" ones on this subject, and for myself I think I can report some progress. I see that I have been looking at it from a little different point of view than the strictly mathematical or scientific one, and imagine that this accounts in some measure for my failure to comprehend the situation more fully. I also wish to acknowledge a fault of mine in quoting as I did from Professor Wood's article without a closer perusal. The fact of the matter is, the paper containing that article got mislaid or lost after I had read it but twice, once merely glancing at it and once more slowly, so that I depended on memory alone at the time of writing, hence my misquotation, if misquotation it is to call a "homogeneous spherical shell" a "homogeneous substance."

I will apologize for not being more careful when quoting from another's writings, and can truly say that I did not mean to misrepresent or misquote, but was honest in my interpretation of the author's meaning.

On the whole, I think that this discussion of weight and mass has been a profitable one, and could myself say a great deal more about it (mostly in questions) if it were not that I believe there are other subjects more practical which better deserve a place in so popular and practical a paper as the AMERICAN MACHINIST.

I have been informed by the editor that my *nom de plume*, "Anti-Know-All," has given offense to some. I did not dream of such a possibility when assuming it, and cannot see how anybody could reasonably gather any implied meaning from such a signature. However, I have humbly consented to change it, and am entirely willing hereafter, if nobody has any objections, to be called just what I am and always expect to be, namely, A LEARNER.

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☞ *We publish nothing in our reading columns for pay, or in consideration of advertising patronage. Space in the advertising pages only is for sale.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Every correspondent, in order to secure attention, must give his full name and address; not necessarily for publication, but as a guarantee of good faith.*

☞ *All communications for, or relating to the reading columns should be addressed to the editor. All other communications to the company, as above.*

☞ *Subscribers can have their mailing address changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

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NEW YORK, JUNE 27, 1895.

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At the annual election of the American Machinist Pub. Co., which took place June 12th, Mr. Fred J. Miller, who has been connected with the paper editorially for nearly eight years, was elected president. His duties, however, will remain much the same as heretofore, *i. e.*, he will retain charge of the editorial department of the paper.

Mr. Horace B. Miller, one of the founders of the paper and president and business manager of the company continuously since its formation in 1879, still retains his interest in the company and is a member of the board of directors, though he retires from active participation in its management.

Mr. C. A. Hansmann, for years attached to the State Department abroad, has been elected secretary.

It is the intention to keep the AMERICAN MACHINIST fully up to its high standard and abreast of the times in every respect.

Some Frauds.

Quite a commotion has been raised in New York recently by the exposure of the fact that much of the so-called and so-stamped "sterling" silverware sold in the department stores was in reality a base metal containing a very small proportion of silver, and in some cases none whatever. As a result a number of very prominent merchants have been arrested, and are likely to be vigorously prosecuted.

Most of those who read this journal will smile at the guilelessness of people who will expect to get articles made of "sterling" silver at a price below the cost of the honest raw material, required to make them, and yet it is a fact that many mechanics and engineers are deceived by tricks that should be as easily detected. Mr. Crane calls attention to one of them in a communication published in another part of this issue, and what he says there of purchasing agents is, we think, specially suggestive.

A well-known mechanic who used to do missionary work in the introduction of an improved mechanical device, found by experience that he could usually do little or nothing with a purchasing agent, because said purchasing agent would seldom be capable of appreciating the difference in value between his device and the common ones, sold at a lower price. This man defined a purchasing agent as "a man who knows the difference between ninety-nine cents and a dollar, and that's every d——d thing he does know." This is probably a little strong, or a little too broad, but, as the record of an opinion based on experience, must be considered as interesting and instructive, nevertheless. It is notorious that most purchasing agents of railroad companies consider price only, and many a battle royal has resulted from the determined effort of a master mechanic to have it recognized that some files are actually better than others, that there is such a thing as varying quality and adaptation in lathes and drill presses, or that some steel at 10 cents a pound is much cheaper than other steel received as a free gift.

In the matter of lard oil, the machinist and tool maker often have to suffer on account of the apparent innocence of a man who seems to imagine that any greasy substance in a barrel having the words "lard oil" stencilled upon its heads, is necessarily pure lard oil, no matter if it is sold at about one-half the regular market price. The man who is responsible for keeping up the quality and amount of work done upon screw machines usually knows that lard oil is adulterated about in proportion to its cheapness, and that so-called lard oil sold at 30 cents when the regular price is 60 cents, is worth considerably less than half as much, if extra toolmaking costs and decreased production caused by its use, are considered. Possibly the man who buys this cheap lard oil, the cheapest steel he can find, and who will not pay a decent price for decent leather belting, may be one of those who is most amused by the foolishness of people who think they are buying sterling silver articles for less than the cost of the sterling silver required to make them.

Retain the Backing Belt.

It is with a lathe as it is with a man. A man's position in life determines his mode of life, and, conversely, to a large extent, his mode of life determines his position in life. So with the lathe. It makes quite a difference what line of work the individual lathe is to be employed in as to the conveniences and appliances that will be required upon it, and, on the other hand, the adaptability of the lathe will largely determine the line of its work. As a general rule, the lathe should be handy all around. This has been recognized in the successive improvements of the lathe. While special lathes are built for many purposes, all around improvement in handiness and adaptability has been the great aim, and the builder who puts a new lathe upon the market, while calling attention to the new and improved features of it, will stoutly deny that anything has been sacrificed to accomplish them.

The backing belt on the engine lathe is not technically, perhaps, a part of the lathe; but, for that matter, neither is the forward driving belt, yet the lathe will not run without it, and it has not such a scope to its running without the backing belt also.

The backing belt, as everybody knows, was added to the engine lathe when it became a screw-cutting lathe. The lathe had no use for the backing belt before that, and for long years afterwards screw-cutting was its only use. The backing motion is, of course, always handy when a face plate is to be taken off, as the spindle will then unscrew itself while the latheman holds the face plate or chuck, and braces himself to lift it off. As the backing speed of the lathe has usually been considerably faster than the speed forward, for the same step of the cone, this has been taken advantage of for polishing purposes. These applications of the backing belt seem to comprise the entire field of its usefulness in former practice. In the earlier screw-cutting lathes the nut upon the feed screw was solid, so that it could not be unclasped from the screw, and then, of course, the backing belt was a necessity. We remember more than one such a lathe in which the thread in the nut was made of babbitt metal, and more than one such nut we have had the honor of rebabbitting. After the split nut appeared it was still a long time before the practice of screw cutting without backing the lathe became general, and it cannot yet be said to be universal. Those who have discarded the backing movement for screw cutting, now find another use for the backing pulley on the countershaft, using it for forward driving at a different speed. The pulleys may be made of such a size that the difference in speed will be one-half of the difference in the step speeds, and this practically doubles the available lathe speeds, though only increasing the total range by one speed at one end of the series.

Still we are sorry to see the backing belt disappearing from the engine lathe. It is doubtful if all the applications of the backing motion have been developed, and it is probable that the sphere of its usefulness might profitably be extended. The backward movement is especially applicable to boring operations. We might say that for all chuck boring the backing movement must be the best, because the latheman then has so much better chance to see the tool entering the hole, and to know all about what it is doing. This suggestion may be regarded as too revolutionary, but it may not properly be condemned until it has been generally and fairly tried, which it certainly has not been as yet. There may be some who are not so hampered by habit as to be unable to experiment upon this line for themselves, and to see what there may be in the suggestion. One difficulty might probably be encountered to prevent a fair trial. Many lathe rests do not allow the tool post to move back far enough for boring at the back of the hole; this, however, would not cause any trouble except for large holes.

Another use of the backing movement for boring we know to be a practical and established success in some shops. Every latheman knows what a ticklish thing it is to carry a boring cut that lifts the spindle. Chattering in this case is almost inevitable, and it is chattering of the most perplexing and incurable type under the old practice. Reverse the revolution of the work, and let the tool cut downward instead of upward, and, of course, this trouble at once disappears. The gibs of the rest must be set up to prevent its lifting, but the trouble from this source is not necessarily worse in the one system than in the other. In the old way of boring the back of the rest will tip up if not properly secured, and in this other way the front of the rest will lift.

We will merely suggest one other condition where the backward revolution would apply with satisfaction in boring operations. In the olden time not every lathe would bore a hole that was absolutely parallel. If a fit is to be made it is not always an objection to have a slight taper to the hole, provided the taper is the right way. It would not be difficult to find machinists who would prefer the slight taper to the hole, and who, if able to bore the hole in that way, would do so. The old lathes had quite a habit of boring taper holes, some slightly taper, some more than slightly, but fully one-half with the taper just in the reverse direction to what was desired. We understand, of course, from lathe builders that this trouble does not appear upon the new lathes, and that they all bore holes that are absolutely parallel, but if anyone should unfortunately be boring a hole upon an old lathe which produced a reverse taper he would only have to reverse the lathe and the tool, boring at the back side of the hole, instead of the front, to get the taper of the hole as desired.

The above suggestions seem to make out quite a respectable case for the general retention of the backing belt upon the engine lathe, whether a screw-cutting lathe or not.

Law versus Mechanical Common Sense.

In the case of Keats *vs.* Nat. Heeling Mach. Co. (U. S. Cir. Ct. App.) it has been decided that employing a set screw on a revolving shaft in the ordinary way is not negligence making a master liable for injuries to his servant caused by the set screw catching the servant's clothing. Nor is the master negligent in not giving warning of the danger from such set screw to an employe who is a mechanic of mature years, has worked on the premises for some time, and might perform his work without danger by adopting a different method of reaching it.

A projecting screw head on a revolving shaft is one of the ugliest and most dangerous things about machinery, but it seems that there is no law against it.

Our item, printed last week, regarding electric motors on the elevated roads in New York, was based upon what we considered reliable information, but had not time to verify before going to press. It is now denied that such a contract has been made, though the matter is being investigated by the elevated road management, and there is little doubt that before long electric motors will replace the present locomotives.

Hiram Maxim, speaking of guns, says:

"War becomes more and more expensive every day. The cheapest thing that a man can have is the club, the most expensive thing is a Maxim gun. The smallest size costs $15 a minute to fire, that is the cheapest one. The 1½-inch gun costs $400 a minute to fire at its maximum speed of 400 rounds a minute."

The figures mentioned would make the cost of firing the 1½-inch Maxim gun about equal to the cost of operating industrial establishments employing a total of 80,000 men.

Those who think there may be "something in Keely's scheme after all," or are impressed by the prominence and undoubted honesty of some of the men who are made to appear as though indorsing it, would do

well to read what President Henry Morton, of Stevens Institute, has to say regarding it, in the *Stevens Indicator* for April, and in the course of an article on "Engineering Fallacies." He evidently does not regard Keely's motor as an engineering fallacy, however, but as a humbug pure and simple.

Literary Notes.

We have received from the secretary, the Tenth Annual Report of the Young Men's Institute of the Young Men's Christian Association, of the city of New York, at 222-224 Bowery. The report makes a very favorable showing for the work done on behalf of young men during the past winter, many of these men being mechanics and others who are employed during the day, and who derive assistance from the various classes in drafting, steam engineering, etc., which are conducted in the Institute.

STEAM AND THE MARINE STEAM ENGINE. By John Yeo, Fleet Engineer, Royal Navy; Fellow of the Royal School of Naval Architecture and Marine Engineering; Member of the Institution of Naval Architects; Instructor in Steam and Marine Engineering, Royal Naval College.

This book is intended for naval officers, and for students of engineering in the earlier part of their training; and the special aim is to give a sound, general knowledge of the subject. The work is mainly descriptive in character, and will aid the student in becoming thoroughly familiar with the names of most of the details of the marine engine, the characteristics of the different parts, and the duty which each has to perform. Rules for proportioning the different parts are not given nor considered. The introduction deals with the general features of the steam engine, application of steam power to propulsion, forms of engines and advance in marine engineering. The various chapters treat on boilers, engines, details of working parts, slide valve, slide valve gear, starting and reversing arrangements, indicator diagrams, properties of steam, expansive working in practice, condenser and fittings, feed water for boilers and their preservation, combustion and fuel, screw propeller and propulsion. The whole matter is treated in a very simple and interesting manner, accompanied by excellent illustrations, making the book a valuable and instructive one for the beginner. The book has been prepared from the author's lectures and notes; it contains 196 pages, 6x8¾ inches, but we regret to say there is no index. The book is published by Macmillan & Co., 66 Fifth avenue, New York. Price, $2.50.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet. We cannot undertake to answer questions in "next issue." This department is usually crowded, and questions must wait their turn to be answered. Neither can we undertake to solve mechanical or engineering problems, and send answers by mail.

(259) E. A. S., Camden, N. J., asks: What will remove the borax from brazed work? *A.*—The borax is best removed by means of a sand blast. 2. What paint or wash is used on brazed work to prevent spelter from sticking to the metal where it is not wanted? *A.*—As far as we know there is nothing used for this purpose.

(260) J. L. O., Chicago, Ill., writes: Please inform me how the ormolu dip is made, such as is used for brass work. I have tried several ways, but have met with unsatisfactory results. *A.*—The ormolu dipping acid is a mixture of niter 6 pounds; sulphuric acid 1 gallon; nitric acid ½ pint; muriatic acid ½ pint. The muriatic acid should be put in last, a little at a time, and the mixture stirred with a stick.

(261) W. H. C., Washington, D. C., writes: Please explain the readings of gas and water meters. *A.*—We cannot explain the readings of these instruments without publishing diagrams to illustrate them, and we think that it is hardly worth while. It is customary to fully explain the readings of gas meters upon the back of gas bills with diagram making the matter plain, and we think this is also general with water meters; at least it should be.

(262) F. N., Mobile, Ala., writes: Kindly give me some information in regard to what course to follow for obtaining a license for running stationary engines. I have charge of a boiler and a 13x20-inch engine, and have some knowledge of engineering, but not as perfect as I would like to have. *A.*—We presume you wish to know a course of study which will enable you to pass an examination for a stationary engineer's license. It is difficult to recommend a course of study, as we do not know to what extent you have studied. Probably a perusal of the "Catechism of the Steam Engine," by J. Bourne, may be of aid to you. A study of this may also suggest some other books which you may need.

(263) E. R. M., Chicopee Falls, Mass., writes: Several years ago a formula appeared in your paper for a mixture to be used in bluing steel. It was composed of black oxide of manganese one part to ten parts of saltpeter. I am using this mixture with varying success, sometimes I have very good results, and at other times I am troubled with red spots. I use a cast-iron crucible in heating the preparation, and think that perhaps the trouble may be in this; the rust in the inner surface is, of course, red oxide of iron, and might, I should think, color the work red, as the black oxide gives it a black color. Please inform me if I am right, and, if so, what material the crucible should be made of. We are very careful as to the degree of heat used. *A.*—The rust may affect the coloring; we should try a glazed earthenware crucible. But in our opinion the unsatisfactory results are probably due to not having the steel surfaces chemically clean.

(264) G. W. C. Baltimore, Md., writes: We have a plain jaw clutch on a countershaft; on the hub of the loose piece of the clutch a pulley is keyed, this pulley is driven from the main line shaft. When the countershaft is to be stopped the clutch is, of course, disengaged and the pulley becomes a loose one. Now what I want to know is a better plan than this, as the sleeve gives us a great deal of bother, and cuts the shaft. If you can make any suggestions I will receive the same gladly. *A.*—If you had given the principal dimensions of shaft, pulley, and clutch we would have been in a better position to make suggestions. It seems to us that the cutting of the sleeve is due to an insufficient bearing on the shaft, it may also be due to the want of proper lubrication. We would therefore suggest to lengthen the sleeve and babbitt it. The pulley should be placed on the center of the sleeve and not near one end, as your sketch indicates. Probably most of the trouble is due to having the pulley out of the center of the sleeve.

(265) J. P. H., Meriden, Conn., writes: Please give me a formula for computing the maximum strength of a helical steel spring, the diameter of the wire being given. *A.*—The greatest safe load can be computed by the following formula:

$$W = .3927\ \frac{S \times d^3}{D - d'} \qquad (1)$$

in which W = safe-working load in pounds, d = diameter of wire in inches, D = outside diameter of coil in inches, and S = greatest tensile stress in pounds per square inch of material, say, 60,000 pounds. Multiplying 60,000 by .3927 we have a constant of 23,562, which may be used in place of S in the above formula, hence the above reduces to

$$W = \frac{23{,}562 \times d^3}{D - d}. \qquad (2)$$

The ultimate carrying capacity will be about twice the safe load. The load as found above is suitable for intermittent working, for springs in steam-engine governors, or safety valves. 2. Please give a simple rule or formula, if there is any, for finding the chord of a circle, the circle being divided into a number of equal parts. *A.*—We presume you want a rule for finding the chords of arcs containing a certain number of equal divisions on the circumference. This is best explained by giving an example. Let the radius of the circle be 7 inches, and the circumference of this circle divided into 24 equal parts. To find the chord of the arc equal to one of these parts, divide 360 by 24; this gives us $360 \div 24 = 15$ degrees for the angle at the center subtended by an arc of $\frac{1}{24}$ part of the circumference. Now find the sine of half this angle, that is, the sine of 7½ degrees, which is given in any table of natural sines, and tangents to the radius of 1; it is .1305; multiply this by the radius, the result will be the length of one-half the chord; thus $.1305 \times 7 = .9135$ inch for one-half the chord, and $.9135 \times 2$ for the length of the whole chord. In the same way the length of chord for any number of divisions on the circumference can be found. Thus, find the chord of an arc containing four of the equal divisions on the circumference. We have found that one division contains 15 degrees, consequently four divisions will contain $15 \times 4 = 60$ degrees; the sine of one-half this angle, that is, the sine of 30 degrees, is .5, multiplying this by the radius we have $.5 \times 7 = 3.5$ inches for one-half the length of chord, and $3.5 \times 2 = 7$ inches for the length of the whole chord.

(266) J. A. C., Buffalo, N. Y., writes: Please give me a receipt for making the ordinary black pencil leads. I have tried several methods but they did not come up to what I want. *A.*—To make pencil leads requires considerable experience. The lead consists of a most intimate mixture of graphite and clay. The graphite is reduced to a fine powder; it is sifted and sometimes treated with mineral acid, to free it from iron, etc., then washed and then calcined at a bright red heat. To get it in the condition of fine division it is mixed with water and poured into a vat, where the heavier particles sink. From this vat the water bearing the lighter particles passes into another of a lower level, and so into one or two more, in each of which the comparatively heavy particles sink, and only the still finer particles are carried over. That which sinks in the last of the series is in a condition of extremely fine division, and is used for pencils of the highest quality. The clay, which must be free of sand and iron, is treated in the same manner, and brought to a state of great uniformity and smoothness. Clay and graphite so prepared are mixed in varying proportions from about equal parts to two of clay for one of graphite according as the pencils are to be hard or soft. They are thoroughly incorporated and ground together, then placed in bags and squeezed in a hydraulic press till they have the consistency of stiff dough, in which condition they are ready for forming pencil rods. For this purpose the plastic mass is placed in a strong upright cylinder of brass, into which a plunger or piston works, moved by a powerful screw press. The bottom of the cylinder consists of a thick bronze plate having in it a number of small apertures of the size of the leads to be made. By application of pressure to the plunger the graphite mixture is squeezed in continuous threads through the holes, and these threads are received and arranged in straight continuous lengths on a board on which they are left to dry for some hours. For further drying by gentle heat they are placed in straight grooves in a board and covered with another board, in which position they harden to stiff rods. These are afterwards cut into lengths for pencils, which are packed with charcoal in a covered crucible and submitted to a high furnace heat. The two elements which regulate the comparative hardness and blackness of pencils are the proportions of graphite and clay in the leads and the heat to which they are raised in the crucible. According as the proportion of graphite is greater and the heat lower the pencil is softer and of deeper black streak.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Wheels, Gear Cutting. Grant; see page 513.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Cam-Milling. Machine Tool Works, Newark, N.J.

Marine Iron Works, Chicago (new catalog).

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Best Presses and Dies for all sheet metal work. Ferracute Machine Company, Bridgeton, N. J.

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Models—Expert—J. C. Seyl, 181 E. Madison St. Chicago, Ill. Intricate movements produced—Catalog M. gratis.

Squaring and Rotary Shears, Tinsmiths' Tools, Presses and Dies for sheet metal work, are made by the Niagara Stamping and Tool Co., Buffalo, N.Y.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

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The Old and the New.*

BY ROBERT ALLISON, PORT CARBON, PA.

At a reunion held at the house in New York of the American Society of Mechanical Engineers, in April, 1893, one of the speakers† made some remarks in reply to the presentation to the society of a portrait of the late Mr. Harrison of locomotive fame. In his remarks he stated that the mechanics who constructed the first locomotives, with the tools and appliances then available, deserved more credit than the mechanics who build the splendid machines of the present day. Having this in mind, I thought it might interest some of the younger members of the society to learn of the difficulties and trials of the old-time machinists, of which the writer was one.

It is now about fifty-one years since I first entered a machine shop as an apprentice, in 1844, my first experience being in the shops of Haywood & Snyder, at Pottsville, Pa. The shops were considered as well equipped as any in the interior of the State; there were two or three slide lathes (not screw cutting) in the shop, but most of the turned work was done with the slide rest, and all the small turning was done with hand tools. There was one planing machine in the shop, the table being pulled back and forth with a common ½-inch chain. I recollect that this chain would break frequently, sometimes two or three times a day, so a number of open links were kept on hand to make quick repairs. The cross feed was automatic; all other feed directions were by hand. Those of you who have had any experience in a modern shop will appreciate the difference between those crude machines and the machines now in use.

The work done in the shops was principally steam engines, and, notwithstanding the poor facilities, many good engines were turned out, some of which are in use to-day.

After working in the Pottsville shops about one year, I was sent to Danville, to the branch shops in that place, my masters having taken the contract to make the machinery for the Montour Rolling Mills, the first mills in the United States to make "T" rails. The mills were constructed under the supervision of Mr. Henry Brevoort—some of you may remember him, as he was located in New York after leaving the Montour Mills. I shall always have pleasant recollections of Mr. Brevoort, as he took special interest in me and my work, and would frequently insist on certain pieces of work being placed in my hands for execution; for, while I was only an apprentice, he thought that I did better than some journeymen.

The shop was equipped with two large lathes, 36-inch swing, mounted on heavy wooden shears, and the turning was done with heavy slide rests; there were also three smaller lathes on wooden shears, with slide rests; and two hand lathes, operated exclusively with hand tools; also one drill press and one screw-cutting machine—this constituted the whole plant.

The whole of the rolling mills proper were built in this shop, the engines being built in

* A paper presented at the Detroit meeting of the American Society of Mechanical Engineers.

† Mr. J. F. Holloway, of New York, ex-president, received in the name of the society the oil portrait of Mr. Joseph Harrison, the gift to the society from his widow, through the influence of his nephew, Mr. Henry Harrison Suplee.

the Pottsville shops. In the early days of rolling mills, you remember, the engines were made long stroke, usually 6 feet, and the rolls were driven with gearing so as to get up the proper speed, the piston speed of the engines being about 300 feet, the gear wheels being large in diameter; there were no facilities for boring the hubs, and they had to be keyed on the shaft with six or eight keys This necessitated much chipping of keyseats.

Shafts were all made of cast-iron of large diameter, with bosses in proper places for wheels; the bosses were turned off, and then eight flat places were chipped and filed true for keys, the wheel hubs were cored out about 1½ inches larger than the shafts, and eight keyseats cut of proper width and taper, according to the size of the shaft; then the wheel was staked on the shaft with four short wedges on each side, leaving four of the keyseats clear. It required considerable skill to get the wheels true on the shafts, and but few were able to make a good job. After the wheels were staked on true, four of the keys were fitted and driven home, the stake wedges removed, and the other four keys fitted. Large cranks were fitted to shafts in the same way. The whole operation required a great deal of skill, and unless a man was an expert chipper and filer he would make very slow progress. The turning of large shafts was slow and tedious; the writer remembers having a cast-iron shaft 10 inches diameter and about 10 feet long being given to him to turn on a hand lathe, with hand tools, the slide rests all being in use, the tools used being hook tools "V" and round nose, button and spike heads. Just imagine the feelings of a machinist of the present day if confronted with a job of that kind! I also remember another job that almost made me sick; this was 40 set screws, 1¾ inches diameter, about 4 inches long; the iron was seamy and hard, they had to be turned from point to head and thread chased the whole length. You can hardly imagine the condition of mind I was in by the time I finished the last screw; and I think that if there had been about five more in the lot, the country would have been obliged to get along without my services as a machinist, as I would have quit the business in disgust.

The chasing of screws by hand was one of the things we all had to learn. Starting the thread properly required considerable skill; drunken threads were rather common, and subjected the producers to considerable ridicule in the shop. All plane surfaces had to be chipped and filed, no matter what size, and good chippers were always in demand. Engine guides were made round because shops had no planers to plane them if made flat; and when the first flat guides were made, they had to be chipped and filed; connecting rod stubs were fitted the same way. Notwithstanding all these drawbacks, very good work was turned out, some of which will compare favorably with the work of the present day. We still have some old fogy machinists who claim that the work of the present day does not compare with old-time work, when accuracy and finish depended on the skill of the workman rather than on the accuracy and automatic operation of modern machinists' tools. The writer has had considerable experience in old-time methods and with modern tools, and has no hesitancy in saying that the work of the present day is far superior to what was turned out by the old methods; but, as Mr. Holloway said in his remarks, the wonder is how such good work was turned out with the limited appliances at hand, and the mechanics of fifty years ago deserve more credit for their productions than those of the present day.

It may interest some of you to have a short account of how a steam engine was produced fifty years ago in the shops where the writer learned his trade. First a large drawing-board was prepared, large enough to make a plan and side elevation, full size. Engines all being made very long stroke, the drawing-boards were quite large; an engine of 14 inches diameter, 48 inches stroke, taking a board about 6 by 20 feet. The engine was plotted down, lines chalked and leaded; patterns were then made to correspond to the drawings, castings were made and fitted, but connecting rod, piston rod, valve rods, etc., were left till the cylinder, guides and pillow block were fitted on bed plate. Measurements were then taken for the different rods, and the rods made the proper length to fit. No two engines were exactly alike; variations in shrinkage and fitting were adjusted in the length of the rods. Generally, after the first engine was made, the drawings were planed out, so that the drawing board could be used for another size. This destroyed the record of sizes, but as all rods were measured for each particular engine, this did not interrupt the work of construction. I need not refer to the present methods in this line, as you are all familiar with them. To-day almost every part of an engine, or other machine, could be made in different shops, widely separated, and then assembled into a complete machine without a hitch. This would have been impossible under the old plan. Taking all the disadvantages into consideration, the wonder is that the mechanics of fifty years ago could turn out as good machines as they did.

President Davis, of the society, remembering the equipment of the Haywood & Snyder shops when he took charge of them, might contribute some interesting material; but at that time they were much improved over what they were when the writer served his apprenticeship in them. I trust he may be able to add something of interest to what I have said on this subject. We would be glad also to hear from those who labored in other lines and in different places.

DISCUSSION.

Mr. Samuel Webber: When I first went to Lowell, in 1841, I made the acquaintance of old John Dummer, who had built all the wooden water wheels then in use there, and who came from the family from which "Dummer Academy," at Byfield, Mass., was named. Afterward, in 1847, I worked a year under Captain Phinehas Stevens, who built the "Bay State Mills" at Lawrence, Mass., and put in the last large "breast wheels" used in New England, so far as I know. The old Masonic emblems of the "level, square, and compass," were the principal apparatus used, and the "broad axe" was one of the most familiar and useful tools. The old "surveyor's compass" was used in laying out the ground, and the "level" was practically as good then as now. "Lathes" for turning wooden columns, shafts, etc., had long timber beds, and were often set up in a convenient saw-mill, and the tool, held in both hands, had a long wooden handle which would reach back under the arm. Large curved work was usually "*scribed* out" on the attic floor of the carpenter's shop, and the "cooper's adze" and "draw knife" were also important tools in working out these curves. Water wheel shafts were usually made of wood with cast-iron "gudgeons," and cast-iron in short lengths was generally used for shafts. These were usually square, but I remember when the late E. A. Straw, of Manchester, N. H., who had been sent to England to examine mechanical matters, came home and fitted up one of the "Stark Mills," in Manchester, with hollow cast-iron shafts which were round. These were afterward taken out and solid wrought iron shafts put in their place, which gave the mill an enormous load of unnecessary dead weight.

Mr. Straw had been brought up by Mr. Boyden, of turbine celebrity, and had commenced engineering on the Nashua & Lowell Railroad.

The large pulleys of those days were all made of wood, on cast-iron hubs and spiders, a form to which we are now returning.

Leather belts were made on the spot as wanted. There was no such thing as a ready-made belt in the market. All the mills and shops bought their leather from the tanners, by the side, and each establishment had its "belt shop," where the hides were cut up and stretched, and afterward the edges "trued," and cemented, stitched, or "pegged" together, wooden shoe-pegs being often used for this purpose. Machine tools were few to those of the present day. The iron planer had just been introduced, and the engine lathe was still a novelty. The first tool I ever worked on had V-ways, which had been chipped by hand, and "draw-filed" to a straight-edge!

Donkey engines were unknown, and all heavy lifting was done by animal muscle applied to levers, or ropes and pulleys.

Dams were usually built of timber, filled in with rough stone, planked on the upper side, and loaded with gravel, and were a prominent feature in the work of the millwright, as were also the flumes or feeders for conveying the water to the wheels, which were square, and made of planks "keyed up" in timber frames.

Large pipe, either of cast or wrought-iron, was unknown. When turbines came into use, the feeders were often made round, of wooden staves, hooped with iron, like a barrel.

Mr. William E. Worthen: It is my impression that not only the "large pulleys were built on cast-iron spiders," but that all pulleys were built up in this way in the early days, making a drum of uniform diameter for nearly the whole length of shaft, and that the shafts were of cast-iron; and even if of wrought-iron, nothing was turned except the journals. There was an advantage in these long drums, that the machines which they drove could be readily shifted laterally and larger drums could be readily constructed on them by board laggings when necessary for a change speed on the machines. The ends of these drums were closed to prevent dust from getting into the central space, and these ends were painted a dark green, which was a favorite color for the frames of machines, which were at that time invariably of wood, usually ash. All machinery of the Lowell Manufacturing Company was made after the designs of Paul Moody, at Waltham originally, afterward at Lowell, and no change was allowed to be made by anyone except with his approval. At the shop there were foremen of the different rooms appropriated to the different machines, to whom the work was let by contract.

The machine shop furnished, set up, and started the machinery of the mills. The superintendents of the mills were not mechanics or manufacturers. The machine shop furnished machines and was responsible for their working. No alteration was allowed, and the superintendent had charge of the work people. They compared the results of the same class of work in the different rooms of their own and other mills, took charge of the boarding-house keepers and the morals of the operators. Under these regulations the mills were a success; but in 1831 Mr. Moody died. There were now many other cotton-mills in operation and throughout the country, and soon the directors of the companies were alive to the new ideas, that there were other machines than their own, and which were improvements in the quantity or quality of the products.

I recollect when the first Whitworth planer was introduced at the machine shop, and went to see it at work, and could appreciate the amount of chipping that it would save. Early in the forties the Lowell Manufacturing Company took a contract of the Reading Railroad for the construction of freight cars, of which the pedestals were made of a single plate of wrought-iron and the jaws punched out by a hydraulic press.

George W. Whistler came to supply Mr. Moody's place, and locomotives were undertaken at the shop, and I had the advantage of seeing the great trouble and trials in working out new designs much larger than the English ones.

Colonel Webber refers to *old* John Dummer—he was about fifty at the time. As a millwright he was the best I ever knew. His designs were good; he took charge of his work personally, never talked but little to his men; in fact, never to anyone unless it was necessary, and his work was joiner work. He would never loan on interest, as he called it usury.

He built the first wheels at Lowell in 1822, and none of them were, I think, ever renewed. The entire fall was at first 30 feet, which was used as a whole at the Merrimac Mills, but at the other mills in divided falls of 17 and 13 feet, as the power could be thus distributed, and sales of real estate extended. The wheels were of one type, wooden breast wheels with cast-iron shaft, in two pieces, coupled together at the center, by a socketed hub; on the journal ends there were large flanges with sockets. Three sets of arms were fitted to these sockets, and braced from the ends to the central arm. The gates were horizontal, sliding over apertures leading vertically down to center of the buckets, usually in three tiers, the lower one being detached except in cases of low water.

Mr. Dummer continued to build these wheels till the introduction of Boyden's turbines, and, although the first ones had wooden flumes, he never took kindly to them or had much confidence in the results, and gave up his business as a millwright and removed into the country.

As the construction of turbines with the precision required by Boyden was then beyond the capacity of most of the mechanics of that time, Mr. Boyden attended to it personally.

In testing the wheel every observation was made independently by two parties, nor was there any connection between other parties of the test, those at the weir with those at the wheel, and Mr. Boyden made separate observations of his own, with the notes of continuous observations. Thus complete, the percentage of effects at different speeds and openings of gate could be readily separated and calculated.

Mr. Boyden came of a remarkable family, strong generally, physically and mentally, of which Seth Boyden was another. In addition to his mental activity he had wonderful persistence; without anything but a common-school education he made his calculations and design, with confidence, and the results were what was looked for, but not in money to him.

In his design and construction of the turbines for the Atlantic Mills of Lawrence, Mass., there was so much delay in construction that the company could not afford them for as long a test as he wished, and to determine the percentage of effect, which was a factor in his remuneration, a commission was appointed of Judge Parker, Prof. Benjamin Peirce, and Mr. James B. Francis, who returned a verdict of considerable over 90 per cent. The factors of the calculation were head of water, speed of wheel, drawings of guides and wheel, and velocity of issue with its direction, that is as far as I recollect. Mr. Boyden made his calculation by arithmetic approximations, but, as Mr. Francis told me, Professor Peirce said that the results were correct, but showed that the work of months by Mr. Boyden, with his usual checks by different calculators, could have been resolved in minutes by use of calculus.

At the Nashua Mills he persisted for months to find out the reason for the smaller percentage than what he expected, keeping his assistants at work during mill hours in the week and also on Sundays, and to their remonstrance that it had got to be monotonous, changed the dinner time of Sunday from half-past twelve to one P. M.

He found the why—it was the reduction of the depth of the guides about two inches.

It has been a pleasure for me to look back and see what I could recollect, and if it were like a civil service examination I could answer interrogatories better.

Mr. Olin Scott: The millwright of fifty years ago was the mechanical evolution of the preceding ages from the times of Archimedes, and was supposed to know everything pertaining to machinery and mills, from a watch movement to a 50-foot over-shot water wheel

Before describing anything pertaining to the methods and apparatus in use by millwrights in the past, it may be well to call

attention to some of the methods and apparatus which we did *not* have at the time I first began working at millwrighting fifty years ago.

At that time there were only three or four short railways in the country, and those amounted to very little as a means for doing business. Steamboats were the "*ne plus ultra*" of human achievement at that time. Just imagine this country to-day without its railways. At that time there were very few steam engines on land, and those used wood for fuel. I traveled a long distance to see the only one running, in a city of 30,000 inhabitants in the State of New York. The telegraph was unknown. The planing machine for planing and matching boards, known as the Woodworth planer, was not in general use; and the Daniels planer, for planing timber straight and true, was only found in a few establishments, and the same may be said of the iron planer now used in every machine shop. The band saw was unknown, and the circular saw for sawing lumber was in but a few mills in the country. Many of the tools in the millwright's tool chest were of the antiquated English style. No ready-made shafting or pulleys were kept on hand. Ready-made belts, crudely made, were just coming into use, and many belts were home-made. Rubber belting and other rubber goods were unknown.

No ready-made bolts or lag screws were to be had. The blacksmith made all bolts, and cut the threads by hand, making them cost 15 to 18 cents per pound, and of inferior iron and workmanship; so that a good millwright, who then worked for $1.25 to $1.50 per day, would work a whole day to make some wooden device to save six or eight pounds of bolts.

Nearly all machinery was driven by water power, and all good mills used the overshot or breast wheels, except saw-mills having the old style, vertically reciprocating saws, some of which used "reaction" wheels, and very few wheels of 100 horse-power were to be found.

The largest and most powerful wheel in the country at that time was an overshot wheel 62 feet diameter, at the Burden Iron Works, at Troy, N. Y. At about the time mentioned, the first turbine wheels for heavy work were put in the cotton-mills at Lowell, Mass. They were of the Fourneyron type, and gave good results; but the cost of such wheels placed them beyond the reach of most mills in the country for many years, so the old millwright was left to plod along in his old way for some years, building overshot and breast wheels, with wood shafts, having cast-iron "gudgeons" for bearings, which wheels most of the mill owners believed could not be equaled for efficiency, to say nothing of being superseded by the "new-fangled" iron wheels, as they were called.

In those days, if a water power was to be developed, the millwright was the man who engineered the building of the dam, races, flumes, and wheel-pits; determined the size of water wheels required, designed the buildings, located the machinery, and arranged the shafting and gearing, also determined the sizes of the gears, shafts, pulleys, and belts to transmit the power to the several machines.

Large pulleys of six feet diameter or more were little used, and were mostly made of wood by the millwright, and large belts such as now universally used were not made, cast-iron gears and frequently cast-iron shafting being used for heavy transmissions of power. Mortise gears for wood teeth were occasionally found, but could be made by only a few shops in the country, and the rough iron pinions which worked with the mortise gears were fitted with cogs of no particular form, some of which were short-lived noisy affairs, while others would run well a long time. Many mortise gears were made by millwrights entirely of wood. I was once the owner of a grist-mill, which was fitted to grind feed (from corn in the ear), corn meal, buckwheat flour, and wheat flour, the mill having, in addition to the mill stones, the usual outfit of elevators, "smutter," hulling machine, conveyor, Boults reels, corn cracker, and hoisting rig to take grain from a wagon at the door; and the only belts in the mill were the canvas belts in the elevators and conveyor, to which the cups were attached, and one leather belt to drive the smutter, for cleaning the wheat, and the mill run many years in that shape before I owned it.

The great amount of experience or practice necessary to qualify a man to be a successful millwright required a large portion of a lifetime, and when we look about us to-day and see how the field of mechanical knowledge has enlarged from a little garden patch to a boundless prairie, and each branch has become a separate department of work more or less scientific in character, and requiring and employing men of the highest ability, we can realize that the progress has been simply enormous.

There is considerable knowledge worth saving from the old millwright practice, which is indispensable to the man doing such work to-day, and I am reminded that few young men are now learning the business, while the demand for practical and reliable millwrights is increasing every day, and I have been puzzled to explain or to understand why our Society of Mechanical Engineers have so completely ignored the subject. While a large part of the motive power which is moving the machinery of the world, and which is now being largely used to generate electricity, is water power, it seems strange that so great part of the time and efforts of every one should be devoted to steam power development and so little to water power, which I think is of equal importance.

Western Foundrymen's Association.

Office of the Secretary,
1522 Monadnock Block.

CHICAGO, June 17, 1895.

TO THE FOUNDRYMEN: At the annual meeting of the Western Foundrymen's Association, it was unanimously decided that its best interests would be advanced by incorporating the association under the laws of the State of Illinois. This will at once be done, and will relieve members from any possible liability in the conduct of the affairs of the association.

The association is now in its third year, and as its formation was closely followed by the panic of 1893, the members feel highly encouraged over the success which it has had, and believe the association must have a brilliant future. The purpose of the association need only be understood to insure a greatly enlarged membership and an increased interest in its affairs.

The objects of the association are not in any way connected with questions of trade, either prices, product, or of wages paid; they are purely and clearly technical, and it is the purpose to make the meetings a medium for the interchange of ideas, of practical experience in founding, so securing from each other knowledge of methods of procedure in certain cases, the consideration of the application of chemistry to foundry business, new methods of molding, and the handling of finished, unfinished, or raw products.

As these objects are more clearly understood, the meetings of the association will become more and more interesting, and it is only necessary to attend a few meetings in order to thoroughly understand what the benefits may be, if followed up.

The cost of membership is extremely low. The initiation fee is five dollars ($5), and the annual dues ten dollars ($10). The literature which is sent out by the association, and which becomes the property of the members, is alone worth vastly more than this amount. A membership taken out by one concern entitles any of its members to attend the meetings of the association, and to join in its deliberations, and the discussions of its papers.

It is particularly desired that members of the association shall endeavor to have their managers, superintendents or foremen, attend the meetings of the association, and join in the discussions. It is the interchange of ideas that the association wishes to procure and put into its records. The association wishes every one to feel entirely at liberty to discuss questions at its meetings, or to contribute papers on matters from individual experience.

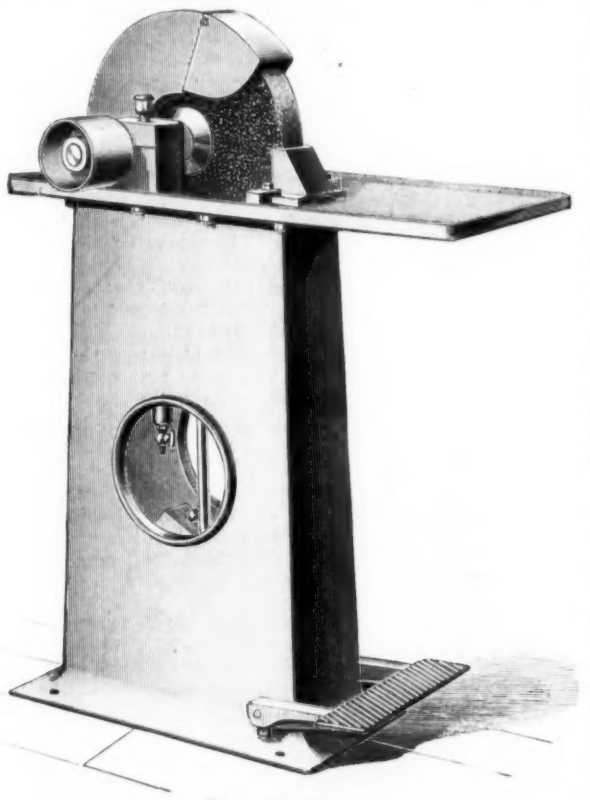
If you are not satisfied to send in your application for membership, through inability to attend all meetings, join the association, and secure its literature, and attend at least some of the meetings.

It is the purpose of the association to arrange, if possible, to hold some of its meetings at other points than Chicago, and as the membership grows, this policy will be followed up with the idea of holding them at various other places, which will enable the members to visit establishments of note and interest to the foundrymen outside of Chicago.

Yours respectfully,
J. M. SWEENEY, *President*.

Tool Grinder.

We publish herewith an illustration of a tool grinder which uses emery or corundum wheels, and is supplied with water carried



TOOL GRINDER.

in a pan below the wheel, to which it is raised by means of the foot-treadle in front, and automatically returns when the foot is removed. The pan is 14 inches by 30 inches and the wheel 14 inches by 2 inches. The machine is made by C. N. Cody, Canastota, N. Y.

Test of Hyatt Elastic Roller.

A test of a roller such as is used in the Hyatt roller bearing was made by Mr. John Geist, engineer of the Wisconsin Bridge and Iron Co., of Milwaukee, Wis. The test was for crushing strength, and was made on an Olsen machine. We illustrated and described this bearing in our issue of October 4th, last year, and it will be remembered that the rollers used are made by coiling a flat strip of steel into a helix so as to form an elastic tube.

The specimen tested was 1¼" diameter, 6" long, and ¼" thick. The following is from the record:

Deflection	1/64"	under	60,000 lbs. pressure.	No set.
"	1/32"	"	80,000 "	" 1/32" perm. set.
3/64" permanent set under			100,000 lbs. pressure.	
1/16"	"	"	105,000 "	"
7/64"	"	"	110,000 "	"
1/8"	"	"	115,000 "	"
9/64"	"	"	120,000 "	"
11/64"	"	"	125,000 "	"
3/16"	"	"	130,000 "	"

(cracking sound.)

At 134,470 pounds the metal commenced to flow so rapidly that the pressure could not be increased until after the top and bottom metal touched.

No tendency to uncoil was observed. The roller was examined after the load had reached 60,000 pounds, and no flat surface could be discovered, nor any deflection whatever.

A New Nomenclature for New Ships.

An order has lately been issued by the U. S. Navy Department establishing the nomenclature applicable to the new line of steel vessels. The terms relating to wooden ships and to vessels with full sail power are not changed. It has been found that the new conditions have invited the making of independent designations said to be often to the disadvantage of officers and enlisted men. The order has to do principally with the decks. Starting with the main deck, which is the highest deck extending from stem to stern, the deck below the main deck, and usually at or near the water line, is the berth deck, and below the berth deck is the orlop deck. A complete deck on which guns are carried between the main deck and the berth deck will be called the gun deck, and if there are two such decks they will be called the gun deck and the lower deck, respectively. This is all the names applicable to complete decks. The deck names applicable to partial or special decks—not generally to parts of complete decks—are: Forecastle, poop, upper, quarter, bridge, protective, middle protective, forward protective, after protective, water-tight and splinter deck. The bridges are designated as *the* bridge and the forward, after, upper, lower and fore-and-aft bridges. Then there is the platform and the upper and the lower platforms. Deck space in general takes the name of the deck above which it is situated, but in some cases from the use to which it is put. It is thought that with the adoption of these designations there should be no difficulty in distinguishing a steel from a wooden vessel in reports made regarding her.

The Crescent Steel Co. utter words of wisdom when they say: Don't forget to make a liberal allowance for finishing any pieces of steel to specified dimensions. Many costly dies and cutters are spoiled by neglect of this important matter, which generally results in dies having soft spots in them, and cutters having teeth not hard enough to do good work. There is no economy in this. Better order the steel a little larger.

The post offices of New York and Brooklyn are to be connected by a pneumatic tube over the East River Bridge for the transmission of mail matter. The location of both offices is very favorable for the arrangement, and the service will be a more extensive application of the system already successfully established at Philadelphia. The tubes are to be of steel and 6 or 8 inches in diameter.

Mr. Wm. F. Torry, Auburn, R. I., sends us a sample of an eraser suitable for draftsmen and others' use. It is so arranged that the rubber is held in a metallic case, the two sides of which are hinged together, and only enough of the rubber to be conveniently used is exposed to handling, and it can be shifted out from time to time as it wears away, and thus be entirely used up.

Mr. F. H. Jackson, of Angelica, N. Y., sends us a sample of a preparation for preventing rust on tools or other articles made

of iron or steel. The preparation is called "Rustena," and we have evidence that it is quite effectual as a rust preventive, and is in no respect objectionable, even its odor being quite agreeable.

Mr. H. A. Gilles, master mechanic of the Norfolk & Western road, sends Dr. Thurston, for the collection of Sibley College, a singular relic of a curious explosion. It is a piece of a piston rod of a locomotive, which exploded when in process of being melted down in a furnace, where it was being reduced as scrap. The probabilities seem to be that the ingot of steel from which the rod was made, was "piped," and that the encaged air or gas, when heated to nearly the melting point of steel, assumed so high a pressure as to explode the rod like a bomb shell. The pressure was, presumably, very high; though the metal, at the high temperature of the melting pot, could not have been very strong.—*Sibley Journal of Engineering.*

[We suggest that the explanation offered is extremely unsatisfactory, although we wish to be excused from presenting a better one.]

Information Wanted.

No plan which we have yet been able to perfect insures our receiving *all* the news regarding new manufacturing enterprises in which machinists are interested. Our friends will confer a favor if they will send to the editor such items of information regarding establishments or proposed establishments in the neighborhood in which they live. We want to know particularly about new establishments and enlargements which will lead to the purchase of machinery of any kind or the employment of men who have to do with building machinery.

Don't assume that we already know what is taking place in your vicinity, but send in the information, by clipping from a local paper or otherwise, and thereby confer a favor upon us and our readers.

NEW CATALOGS.

We have received from the Henrici Laundry Machinery Co., 256 Broadway, New York, a very finely gotten up catalog illustrating and describing machinery for use in laundry work. It is 8¼"x10".

We have received from Samuel C. Rogers & Co., 14 Wells street, Buffalo, N. Y., a catalog illustrating and describing various forms of machinery adapted to grinding saws and machine knives of all kinds. It is 6½' x4½".

The Electric Emery Wheel Co., 24 Mechanic street, Hartford, Conn., send us a folder with price list and description of emery and corundum wheels made by a new process. The wheels are very highly recommended, and are said to be very efficient.

MANUFACTURES

A new machine shop will be erected by Isaac Glazebrook, of Rensselaer, Ind.

The Oxley Stave and Cooperage Co. will erect a $100,000 plant at Greenville, Miss.

The Roth Gas Engine Co., of Cincinnati, Ohio, propose establishing works at Aurora, Ind.

W. A. Cole, of Putney, Vt., has concluded to rebuild his mill, which was burned last spring.

It is said that a new electric railroad will be built to run from Brockton to East Bridgewater, Mass.

The Eastern Metal Supply Co. has been organized by Geo. H. Sibell and B. C. Bachroch, with a capital of $25,000.

The Granby Cotton Mills Co., of Columbia, S. C., has been incorporated by C. H. Manning, with a capital of $150,000.

The Kansas City (Mo.) Die and Machinery Co. has been incorporated recently by W. W. Bradley and Fred. W. Durner.

The Trenton (Mo.) Handle Mfg. Co. has been incorporated by Henry Baker and others, with a capital of $10,000.

The Automatic Air and Steam Coupler Co., of East St. Louis, Ill., has been organized with a capital stock of $3,000,000.

A Connelly gas motor car, recently built at New Castle, Pa., is to be run on the Brooklyn, Bath & West End Railroad.

The Chicago (Ill.) Metallic Cushion Co. has been organized by Chas. Raddin and Z. S. Holbrook, with a capital of $100,000.

Vance & Meyers contemplate the erection of a boiler shop at Muscatine, Iowa, 30 by 65 feet, fitted with modern machinery.

The Mutual Lumber Co., of Meridian, Miss., has been organized with a capital stock of $1,000,000. F. C. Jocelyn is interested.

It is rumored that a $200,000 cotton-mill company is to be organized at Montgomery, Ala. Jacob Griel is interested.

The Charles Smith Mfg. Co., of Chicago, Ill., has been formed by R. C. Morse and J. W. Armstrong, with a capital of $10,000.

The Chattanooga (Tenn.) Implement Works, lately incorporated by L. W. Llewllyn and T. E. H. Urmston will shortly erect a plant.

The Bronson Patent Placer Mining Machinery Co., of Denver, Ohio, has been organized with a capital of $100,000. T. J. Zollars is interested.

The Sterling Cycle Works have decided to locate their plant at Kenosha, Wis., where they will employ 400 men. They have a capital of $100,000.

The Genese Compressor and Molding Machine Co., of Baltimore, Md., has been formed by David Genese and Lewis J. Cohen, with a capital stock of $10,000.

The American Forge and Rolling Mill Co., of Litchfield, Ill., is a newly organized enterprise, with a capital stock of $250,000. Geo. W. Amsden is among the incorporators.

The Morton Mfg. Co., of Muskegon Heights, Mich., report business improving, and state that they have recently shipped one of their shapers and one of their keyseaters to Berlin.

The Denver (Col.) Engineering Works Co. has been incorporated with a capital of $150,000, to manufacture mining machinery. Its incorporators are Henry R. Wolcott and H. H. Dunham.

The Greenmount Iron and Manufacturing Co., of Baltimore, Md., has been organized by Charles de Bullet and others, with a capital stock of $20,000. The company will do a general foundry business.

The Norwalk Tramway Co., of Norwalk, Conn., have placed the order with the Berlin Iron Bridge Co., of East Berlin, Conn., for a car barn 45 feet in width, and 160 feet in length, constructed entirely of iron.

The United States Projectile Company, of Brooklyn, N. Y., report a steady increase in trade, and are adding additional machinery to their plant. They have just placed their order with the Lodge & Davis Machine Tool Co., of Cincinnati, Ohio, for three of their heavy 24-inch standard engine lathes.

A few Milwaukee (Wis.) capitalists are to furnish the necessary capital to build a new railroad from Oshkosh to Berlin, Wis. The contract for the work is about to be let to Chas. and John Martin, of Oshkosh, Wis. The right of way for the entire distance has been obtained. The estimated cost for building and equipping the line is $300,000.

The Terminal Railway of Buffalo, N. Y., has been incorporated to operate a steam road from Blasdell to Depew, N. Y. Its capital is $500,000. The directors are: John M. Brinker, Robt. W. Jones, H. L. Sprague, Algeron McKay, Charles F. Smith, A. J. Grant, Frank Hammond, Wm. Baker and Chas. E. Harmon, all of Buffalo, N. Y.

The Rice & Sargent Engine Co., of Providence, R. I., has received an order for a vertical engine 28 and 60x48, 1,800 horse-power, 100 revolutions, 150 pounds steam, with pulley fly wheels adapted for a rope drive, and also a standard engine 12x30, 75 horse-power, 110 revolutions, for the Whitman Mills, New Bedford, Mass.

The Buffalo Forge Co., of Buffalo, N. Y., are finding a very considerable demand for a special form of apparatus used in connection with their fans for assisting in the operation of burning brick in kilns. It is found that currents of air properly directed very much facilitate the operation, and that it is possible to draw the heat from one kiln to another, and also to use the apparatus in cooling off the kilns after the burning has been completed.

In our announcement last week regarding the withdrawal of Mr. E. W. Bliss from some of the corporations with which he is connected, the impression might have been given that it is his intention to also withdraw soon from the E. W. Bliss Co. and the U. S. Projectile Co. We are informed, however, that this is not his intention, but that one of his objects in severing his connection with the other companies was that he might devote more time to the affairs of the two companies named.

Machinists' Supplies and Iron.

NEW YORK, June 22, 1895.

Iron—American Pig—We quote standard brands, $13 for No. 1; $12 for No. 2; $11.50 to $11.75 for No. 2 Plain, and $11.25 to $11.50 for Gray Forge. Southern brands, $12.50 to $12.75 for No. 1; $12 to $12.25 for No. 2; $11.50 to $11.75 for No. 3; $12 to $12.25 for No. 1 soft; $11.75 to $12 for soft; and Foundry No. 4, $11.25 to $11.50.

Antimony—The market is inactive, a moderate business of routine type only has been done. We quote L. X., 8¼c. to 8¾c.; Cookson's, 8¼c. to 8½c.; Hallett's, 7¼c. to 7.15c.; U. S. French Star, 7½c.; Japanese, 7c. to 7⅛c.

Lard Oil—Prime City we quote at 52c. to 53c.

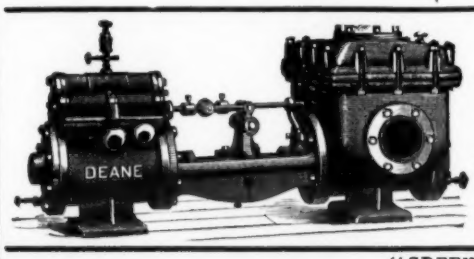
Copper—The market remains firm but very dull. Producers hold out for 10¾c., but some business has been done at 10½c., and even as low as 10c. Casting Copper is quoted at 10c.

Lead—The market is quiet, demand moderate, and prices have declined a little. The quotations are 3.25c. to 3.27½c., but holders are reluctant to accept the former figure.

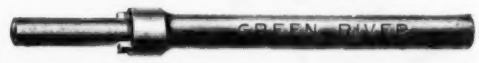
Spelter—Prices have weakened a little; 3.70c. is the figure quoted for New York delivery. Smelters are waiting for higher prices and do not send out for sale much of the metal.

Tin—The market is quiet and prices have declined; 13.80c. to 13.85c. cash are about the best figures quoted.

STEAM BOILERS,
BY
ROBERT WILSON and J. J. FLATHER.
12mo, Cloth, - $2.50.
JOHN WILEY & SONS,
NEW YORK.



THE DEANE
OF HOLYOKE
TANK PUMPS,
ALL STYLES.
THE DEANE STEAM PUMP CO.,
HOLYOKE, MASS.
Send for "The Deane Specialties."

"GREEN RIVER" PAT. SPIRAL FLUTED SHELL REAMERS AND ARBORS IN CASES.
SEND FOR CATALOGUE.


WILEY & RUSSELL MFG. CO., Greenfield, Mass., U. S. A.

Crescent Steel Co.
PITTSBURGH, PA.
CHICAGO, ILL.
NEW YORK, N. Y.
THE FINEST STEEL MADE.
Crescent Special
FOR DIES AND TOOLS DOING VERY HARD WORK.

Buffalo FAN SYSTEM
OF HEATING & VENTILATING
BY A FORCED CIRCULATION OF WARM AIR.
ALL LARGE BUILDINGS.
BUFFALO FORGE CO.
BUFFALO, N.Y.

"R. MUSHET'S SPECIAL STEEL"
SAVES LABOR in being able to run at GREATLY INCREASED SPEEDS. FEWER GRINDINGS. No WASTE in redressing.
SOLE REPRESENTATIVES IN THE UNITED STATES.
B. M. JONES & CO.,
BOSTON: 11 & 13 Oliver St., NEW YORK: 143 Liberty St.

BLOW YOUR FORGES
WITH A
"STURTEVANT BLOWER."
SEND FOR CATALOGUES.
B. F. STURTEVANT CO.
BOSTON. NEW YORK. PHILADELPHIA. CHICAGO. LONDON, ENG.

"AYE, THERE'S THE RUB."
The price at which we are selling (not offering, but selling) our lathes and tools is causing surprise. We are prepared to turn out high-grade tools at very low prices; our profits are small, but we are satisfied, and we give satisfaction to our customers, so there's both profit and glory.
Our catalogue will tell you all about our lathes, planers, shapers, etc. Prices quoted on application.
SEBASTIAN LATHE CO.,
117 and 119 Culvert St., CINCINNATI, OHIO.

REPAIR BICYCLES FOR A LIVING.
Easy way to make good living. FULL OUTFIT. Bellows, Blowpipe, Vise, Spoke Threader, Solder, Borax, ready to go to w rk. Catalogue for 6 cents in stamps. FRASSE CO., 17 Warren St., NEW YORK.

BORING AND TURNING MILLS
ARE SUPERIOR TO LATHES FOR FACE PLATE WORK.
We have a variety of sizes and a large stock for immediate shipment.
THE BULLARD MACHINE TOOL CO.,
E. P. BULLARD, Pres't. BRIDGEPORT, CONN.
New York Office, 86 LIBERTY STREET.

H. W. JOHNS'

ASBESTOS SECTIONAL PIPE COVERINGS.
NON-CONDUCTING COVERINGS FOR STEAM AND HOT WATER PIPES, BOILERS, ETC.
ASBESTOS BOILER COVERINGS.
H. W. JOHNS MANUFACTURING COMPANY,
H. W. Johns' Asbestos Millboard, Sheathings, Building Felts, Fire-Proof Paints, Liquid Paints, Asbestos Roofing, Etc.
87 MAIDEN LANE, N. Y. JERSEY CITY, CHICAGO, PHILADELPHIA, BOSTON, LONDON

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS.

On and after July 4th this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Wanted—Agents traveling and local to sell steam spec's; good commission. Mfr.,1115 State St, Erie, Pa.

Experienced mechanical draftsman with technical education, wants position. Box 33, AM. MACH.

Mechanical draftsman wishes to change position July 1st; specialty, gun work, jigs and fixtures; A1 ref. Box 32, AMERICAN MACHINIST.

Thorough all-round machinist, 20 years experience; engine building; jobbing; desires resp. position. Address Marine, AMERICAN MACHINIST.

Wanted—Thorough mechanic, with necessary executive and practical experience, to superintend a bicycle factory. Address Box 25, AM. MACH.

Wanted—A few first-class machinists familiar with engine work. Address P. O. Box 513, Denver, Colorado.

Wanted—Foreman boilermaker; must furnish best of reference and give full particulars. Address C. C. C., P. O. Box 2132, New York.

Wanted—Machinist capable of doing the finest kind of vise and lathe work; light experimental machinery. Box 28, AMERICAN MACHINIST.

Wanted—Position as foundry foreman; experienced on engine, machine tool, and jobbing work; good references. T. W. W., AM. MACHINIST.

Wanted—Competent foreman to take charge of wood and metal patternmaking in agricultural works. Address No. 418, care AM. MACHINIST.

An experienced designer on light machinery, tools for stamping, etc., and who can handle men, seeks a situation with a cycle or tool company. Box 29, AMERICAN MACHINIST.

Mechanical draftsman, age 24, desires to change position; experienced in mill building and general machine work, also familiar with steam engine indicator; good refs. Draftsman, AM. MACHINIST.

Position wanted by first-class mechanic familiar with gas engine practice and theory; capable of turning out a satisfactory article cheap. Address Practical, Box 31, AMERICAN MACHINIST.

Engineer, machinist and draftsman, with technical education and long practical experience in designing, estimating and mfg. machinery desires engagement. H. P., AMERICAN MACHINIST.

Wanted—Place as foreman or supt., by practica, man of large experience who believes in jigs and special tools for quick accurate work. Address A. D., AMERICAN MACHINIST.

Wanted—Position as foreman or to lay out in boiler or gas holder works; 10 years' experience as foreman; A1 references. Address Box 34, AMERICAN MACHINIST.

Wanted—Superintendent and mechanical engineer; one thoroughly capable in designing Corliss engines of all kinds and the handling of 300 men; an experienced man only. Address, with references, A. B. C., care of AMERICAN MACHINIST.

Foreman wanted for a machine shop not far from Chicago. About 150 men employed on medium heavy work. Modern equipment and methods. Good salary and permanent position for a thoroughly competent man. Address Box 21, AMERICAN MACHINIST.

Wanted—An energetic foreman of a bridge mfg. company's machine shop. Should be familiar with bridge work, machinery of plant, and capable of general repairs. State age, experience and salary expected. Plant is a large one, and good salary paid to competent man. X. Y., AM. MACHINIST.

Wanted—Foreman for machine shop, preferably with experience on high class engine work, to alternate with present foreman on night and day force; permanent position to the right man; state experience, and give references. Address Box 30, AMERICAN MACHINIST.

Superintendent Wanted—To take charge of a brass shop; one who is acquainted with the melting of metals, and the manufacture of all kinds of valves, cocks, etc., for steam, gas and water service. Only first class man need apply. State age, experience and salary expected. Box 23, AMERICAN MACHINIST.

Wanted—Assistant foundry foreman in a New England city; must be accustomed to light and heavy machinery and steam engine work, acquainted with the latest and best foundry methods, and have first-class executive ability and push; state nationality, age, and give full account of experience; give references and state salary expected. Address New England Foundry, care AMERICAN MACHINIST.

A general manager wanted for a steam engine and dynamo-electric manufacturing establishment; must have experience, energy and executive ability, and be able to put some capital into the business; a modern plant, located near New York, costing over $200,000; a "going concern," with abundance of profitable orders already secured, offers unusual inducements for capital and experience. Address, giving experience and references, F. J. K., Post Office Drawer 171, Buffalo, N. Y.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 25 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—A first-class key-seater, new. Address Mitts & Merrill, 913 Tilden St., Saginaw, Mich.

Best and cheapest Bolt Header made by C. H. Baush & Sons, Holyoke, Mass.

(*Continued on Page* 514.)

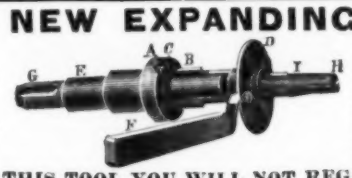
LECOUNT'S NEW EXPANDING MANDREL.

Amateur's Size.

Taking anything from ⅛ to 1 inch inclusive.

Price.....$5.00

Patented Dec. 25, 1877.



Machinist's Size.

No.			Price.
1	⅛ to 1	in.	$10
2	1 "	1½ "	14
3	1½ "	2 "	18
4 (with screws)	2 "	3 "	32
5 "	3 "	4 "	44

IF YOU WILL TRY THIS TOOL YOU WILL NOT REGRET THE EXPENSE.
C. W. LECOUNT, SOUTH NORWALK, CONN.
SPECIAL MANDRELS FOR SPECIAL JOBS MADE TO ORDER.
These goods are for sale by CHAS. CHURCHILL & CO., L't'd. 21 Cross St., London, England.

DON'T ACCEPT ANY SUBSTITUTE FILE.
INSIST ON HAVING
NICHOLSON

NICHOLSON FILE CO.

PROVIDENCE, R. I., U. S. A.

3000 VARIETIES FILES
[X. F.] & INCREMENT CUT FILES.

BETTS MACHINE CO.,
WILMINGTON, DEL.
MACHINE TOOL BUILDERS.
Improved Patterns! Late Designs!

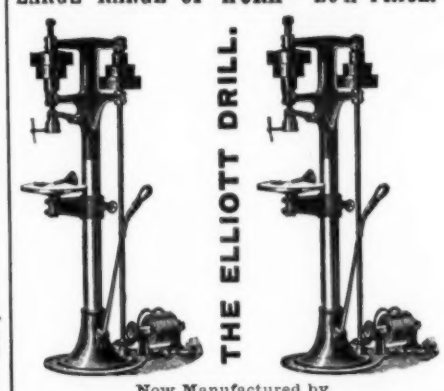
GRANT GEARS

Ready Made Iron Gears.
Ready Made Brass Gears.
Gears Made to Order.
Gear Cutting.
1895 Gear Book, Free.
Treatise on Gears, $1.00.
GEORGE B. GRANT,
Lexington, Mass.,
and 125 South 11th St.,
Philadelphia, Pa.,
and 86 Seneca St.,
Cleveland Ohio.

BEVEL GEARS,
Cut Theoretically Correct.
Special facilities for cutting worm wheels.
HUGO BILGRAM,
MACHINIST,
440 N. 12th St., Philadelphia, Pa.

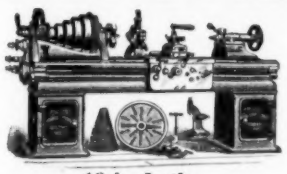
CALIPER SQUARES
Any Style or Graduation.
5 Sizes, Metric and Vernier System.
WARRANTED ACCURATE.
Send for Catalogue and Special Prices to
E. G. SMITH, Columbia, Pa.

The Elliott Drill Press
FOR ANY LIGHT WORK.
LARGE RANGE OF WORK—LOW PRICE.



Now Manufactured by
A. J. WILKINSON & CO.,
180 to 188 WASHINGTON ST., BOSTON, MASS.
SEND FOR CATALOGUE.

FITCHBURG TOOLS.



18 in. Lathe.

IF QUALITY AND QUANTITY OF WORK FROM A MACHINE COUNTS,
THEN INSPECT THE TOOLS MANUFACTURED BY
FITCHBURG MACHINE WORKS,
FITCHBURG, MASS.
Ask for CATALOG E. Send for List GOOD 2d HAND TOOLS.

BUILDERS IRON FOUNDRY,
FOUNDERS AND MACHINISTS,
PROVIDENCE, R. I.
We can guarantee that our castings will be uniform and of high tensile strength. Tensile strength of ten specimens taken from an air furnace heat:

34,260 lbs.	34,390 lbs.	32,600 lbs.	33,200 lbs.	34,400 lbs.
36,420 "	34,650 "	32,460 "	36,550 "	36,700 "

ABSOLUTELY K & M FIRE-PROOF.

MAGNESIA

SECTIONAL STEAM PIPE AND BOILER COVERINGS.

SELLING AGENTS.
Boston, S. C. Nightingale & Childs, 134 Pearl Street.
New York, Robert A. Keasbey, 54 Warren Street.
Philadelphia, Macan & Co., 1420 Callowhill Street.
Baltimore, Wallace & Bro., 432 East Pratt Street.
Washington, Wm. B. Morgan, Room 19, Builders' Exchange.
Chicago, Walch & Wyeth, 208 Lake Street.
New Orleans, Delbert Engineering Co., 23 Union Street.
Memphis, Symmes & Co., 162 Front Street.
Milwaukee, Wis., F. Sprinkman, 133 Sycamore Street.
St. Louis, F. Bocler, 108 Walnut Street.

THE GREAT COAL SAVER.
Manufactured by THE KEASBEY & MATTISON CO.
CINCINNATI: 114 W. Second Street.
AMBLER, Pennsylvania.
CLEVELAND: 117 Water Street.

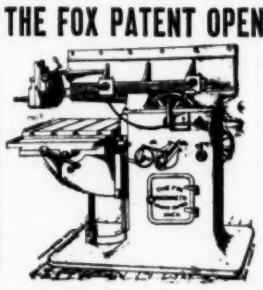
SELLING AGENTS.
Detroit, S. P. Conkling, 20 Atwater Street, East.
Minneapolis, Arthur L. Otto, 219 South 3d Street.
Des Moines, J. C. & R. B. Carter.
Omaha, Spencer Otis, 307 S. Sixteenth Street.
Kansas City, J. H. Storer & Co.
Denver, C. W. Badgley & Co., 18th and Market Streets.
Salt Lake City, Utah and Montana Machinery Co.
Butte City, Montana, R. W. James.
Montreal, Sclater Asbestos Mfg. Co.
San Francisco, De Solla & Deussing, 2 California Street

ROOTS' NEW ACME HAND BLOWER.
For Blacksmiths, etc. Slow Speed, Positive Blast. Is Durable Compact and Cheap; also Portable Forges, Tuyere Irons and Foundry Blowers.

P. H. & F. M. ROOTS, Mfrs.
CONNERSVILLE, IND.
Chicago Office: 1405-10 MANHATTAN BUILDING.
COOKE & CO., Selling Agents,
163 & 165 Washington St., NEW YORK.
Please Mention This Paper.

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
810 Walnut St., Philadelphia.
☞ Our New and Revised Catalogue of Practical and Scientific Books, 88 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

THE FOX PATENT OPEN SIDE SHAPER.



No springing of ram. No overhanging table. Quick Return, Stroke Under Perfect Control. Can be Instantly Adjusted 1-16 in. or 24 in. No Screws to Monkey with. Powerful, Quick, Accurate. Write for circular.
The Fox Machine Co.,
325 N. Front St.,
Grand Rapids, Mich.
135 Finsbury Pavement, London, England

JESSOP'S STEEL
FOR TOOLS, DRILLS, DIES, &c.
ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
Chief Am. Office, 91 JOHN ST., N. Y.
WM. JESSOP & SONS, LTD.
Established a century ago.
Medal World's Columbian Exposition 1893.

CHICOPEE, MASS., May 15, 1895.
Mess. HOUGHTON & RICHARDS,
BOSTON, MASS.
We are pleased to say that for Forming Tools we never have seen anything equal to the Styrian Steel. We shall use more of it than before, and shall be pleased to endorse it at any and all times.
Yours truly,
AMES MFG. CO.

HOUGHTON & RICHARDS,
SOLE AMERICAN AGENTS,
148 & 150 OLIVER ST., BOSTON,

WORTHINGTON STEAM PUMPS
FOR ALL DUTIES.

HENRY R. WORTHINGTON,
NEW YORK, 86 and 88 Liberty St. BOSTON, 70 Kilby St. PHILADELPHIA, 607 Arch St. CLEVELAND, 24 South Water St. CHICAGO, 185 to 189 Van Buren St. ST. LOUIS, Eighth and St. Charles Sts. INDIANAPOLIS, 64 South Pennsylvania St.

Wanted—A purchaser for a good key-seater, by Mitts & Merrill, 913 Tilden Street, Saginaw, Mich.

Bicycle Repair Outfit. Send 6 cents postage for full illus. catalog. Frasse, 17 Warren St., New York.

For Sale—Second hand planer, also lathes. Gage Machine Works, Waterford, N. Y.

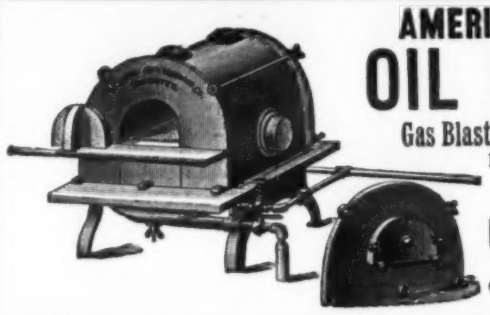
For Sale—Machine shop and foundry in prosperous city; a good chance for limited means; easy terms. W. W. Taplin, Neillsville, Wis.

Wanted—To correspond with any one in need of a first-class key-seater. Address Mitts & Merrill, No. 913 Tilden Street, Saginaw, Mich.

For sale or rent—Machine business in New England town; foundry and pattern shop adjoining. Reason for selling, poor health of proprietor. Address "L.," AMERICAN MACHINIST.

For Sale—A foundry and machine shop with tools, in the thriving town of E. Stroudsburg, Pa.; water power; terms easy. Address Box 516 for further particulars.

A well-known machinery firm desires to make arrangements with a reliable manufacturing company to build a well-known line of machinery; a concern wishing representation in New York and within an hour's ride preferred. F. M., care AMERICAN MACHINIST.



AMERICAN GAS FURNACE CO.,

OIL GAS PLANTS

Gas Blast Furnaces & High Pressure Blowers

For the economical generation and systematic application of HEAT.

CATALOGUES ON APPLICATION.

No. 80 Nassau St., - NEW YORK.

ENGLISH AGENCY:
Chas. Churchill & Co., Ltd., 21 Cross Street, Finsbury, London, E. C., England.

ESTABLISHED IN 1874.

CLEVELAND TWIST DRILL CO.

99 Reade Street, New York.
85 Queen Victoria Street, London, Eng.
5 Neue Promenade, Berlin, C., Germany.
Cor. Lake and Kirtland Streets, Cleveland, O.

NEW AND SECOND-HAND MACHINERY.

ENGINE LATHES.

13 in. x 6 ft. Blaisdell.
14 " x 6 " Flather.
16 " x 6 " Blaisdell.
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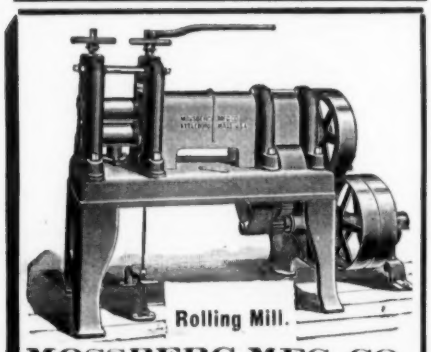

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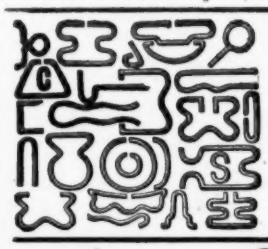

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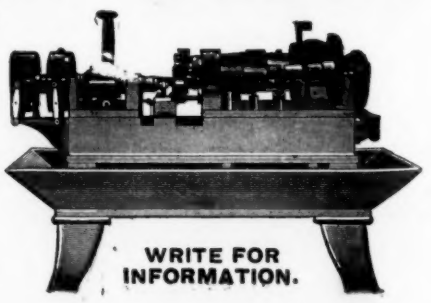

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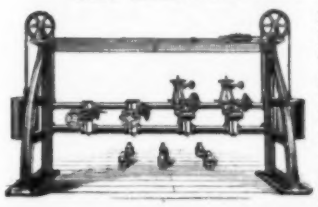

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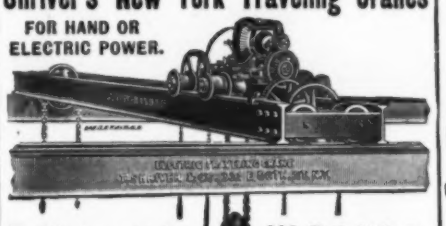

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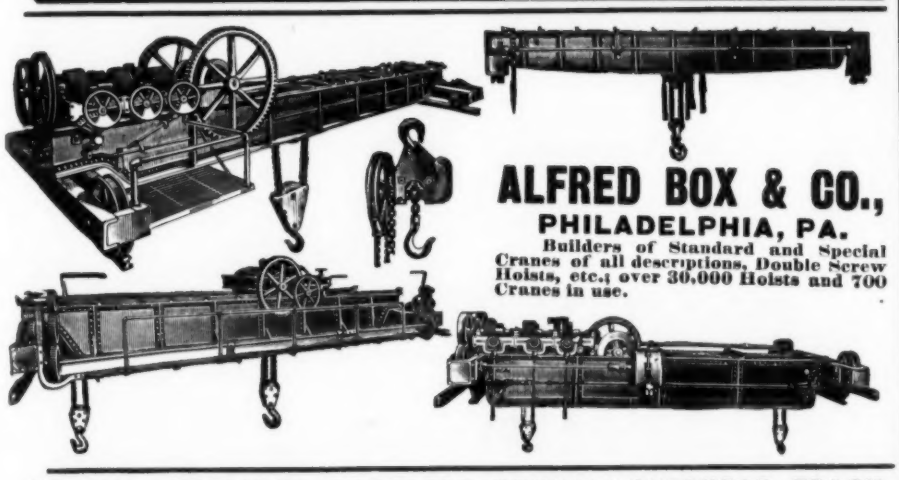

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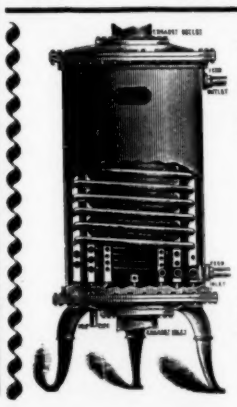

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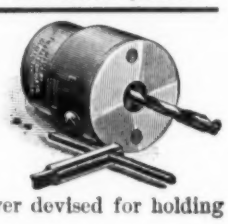

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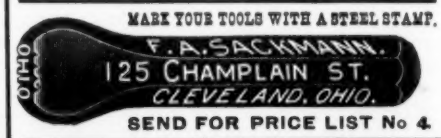

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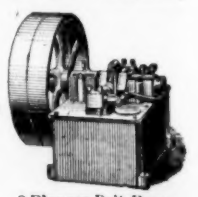

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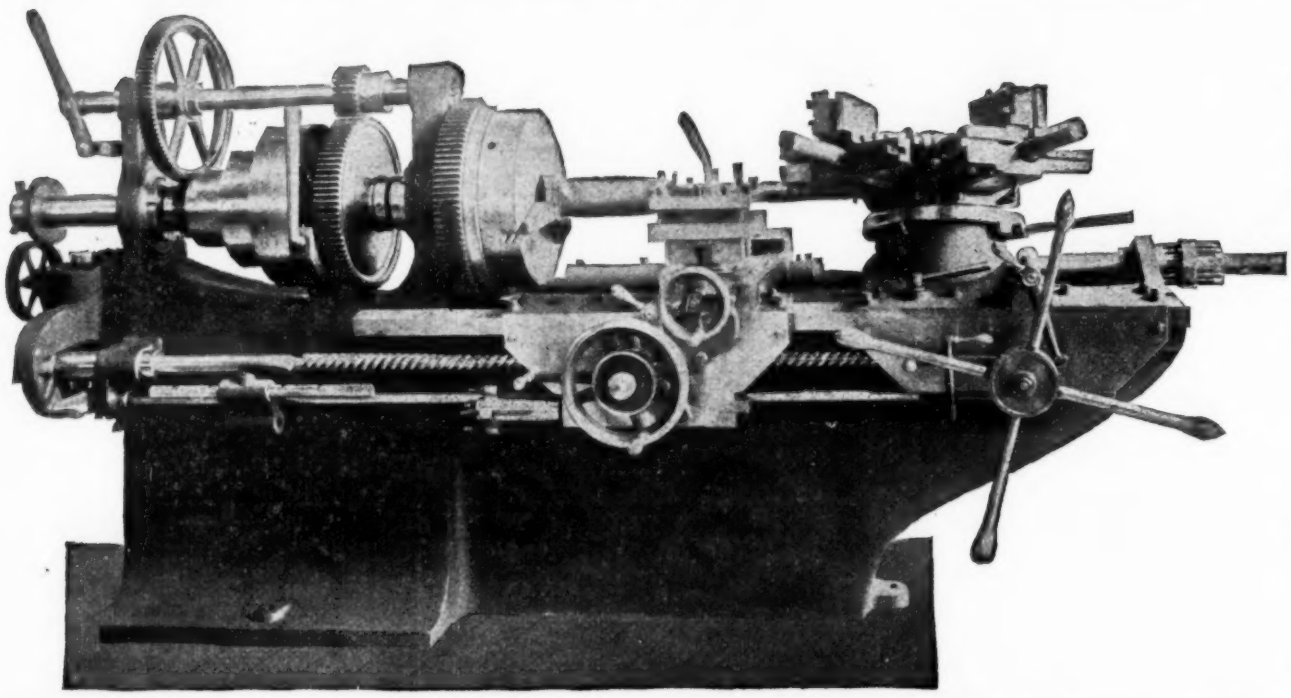

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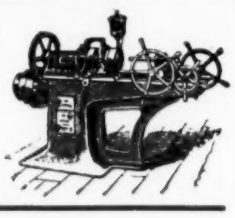

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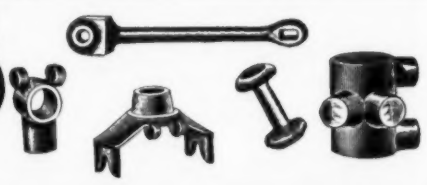

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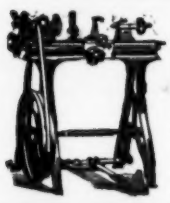

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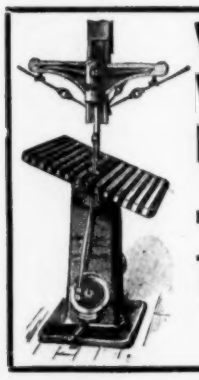

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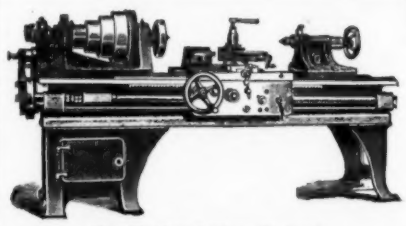

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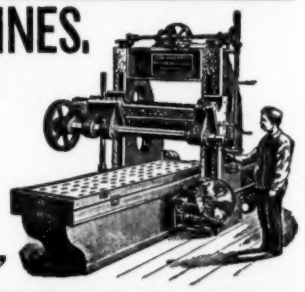

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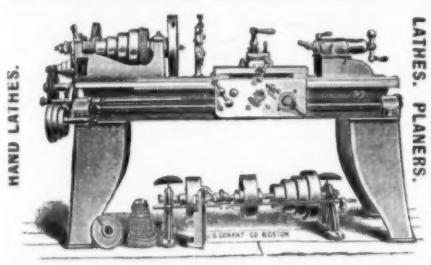

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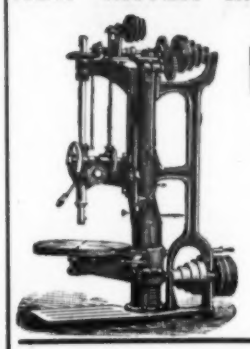

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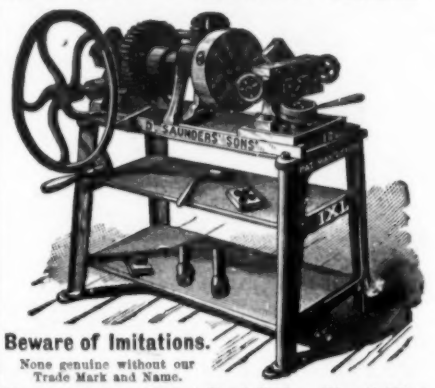

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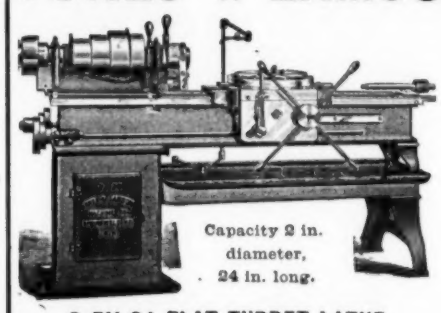

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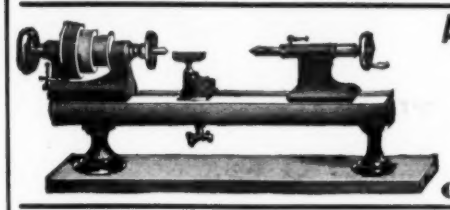

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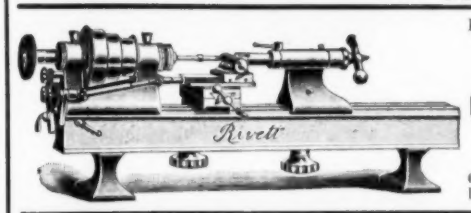

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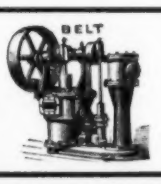

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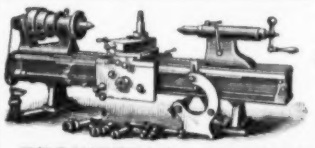

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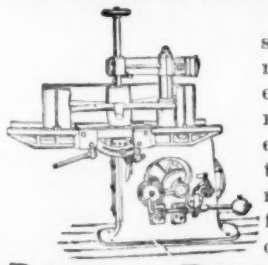

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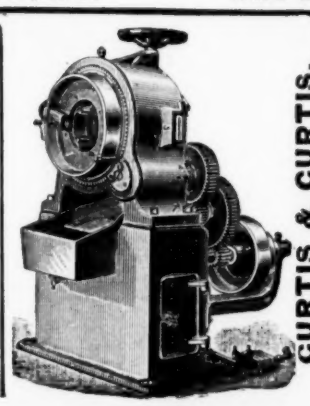

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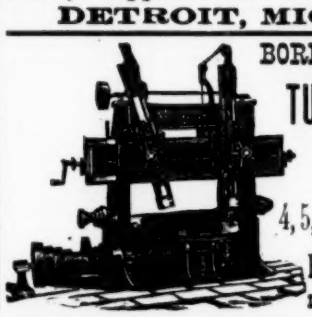

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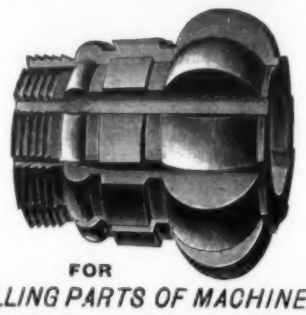

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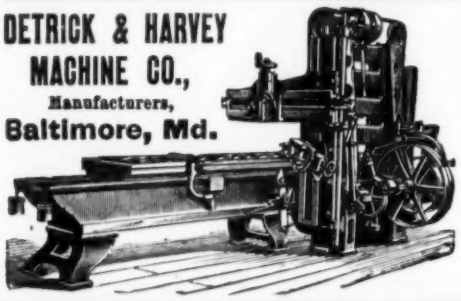

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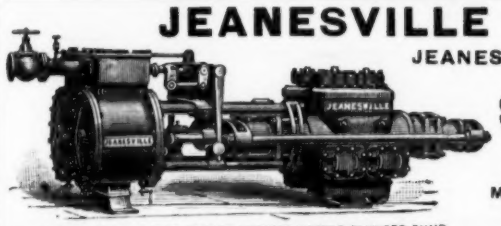

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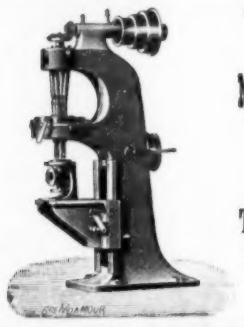

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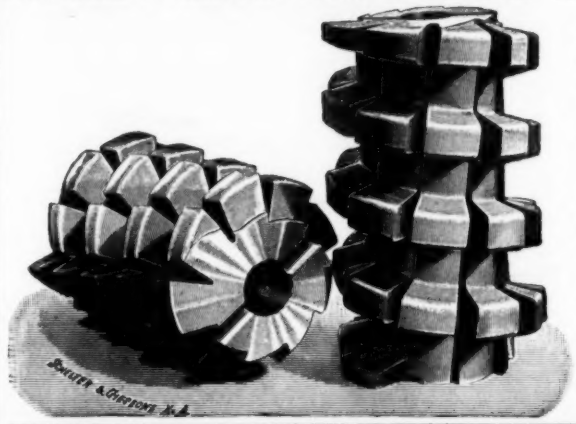

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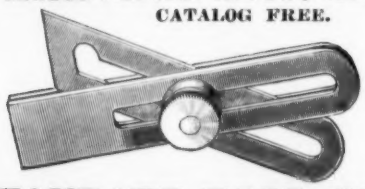

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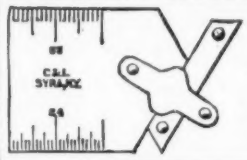

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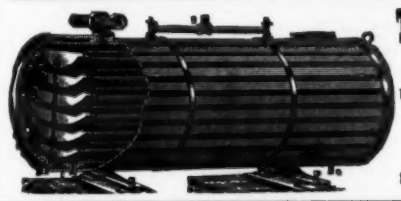

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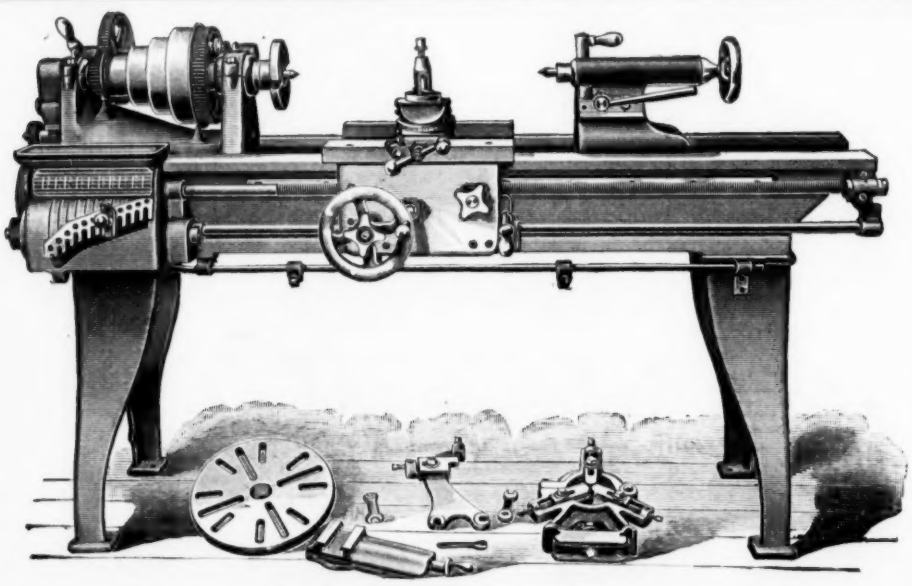

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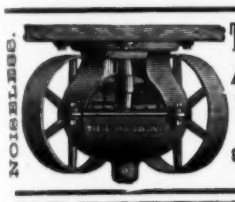

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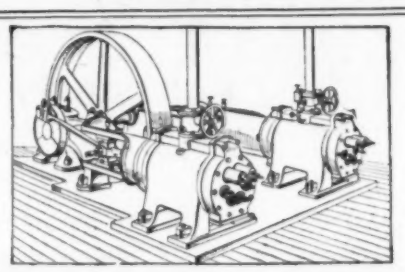

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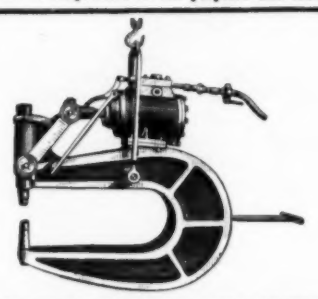

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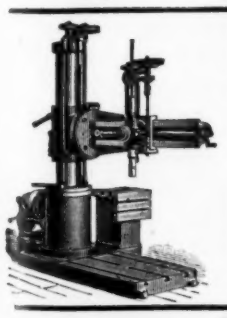

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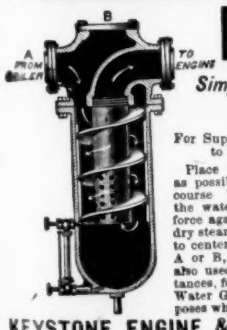

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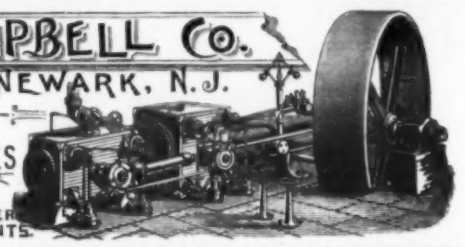

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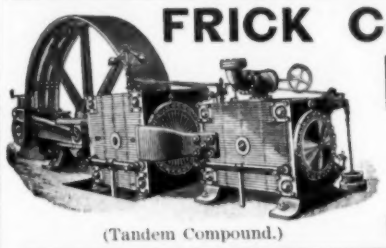

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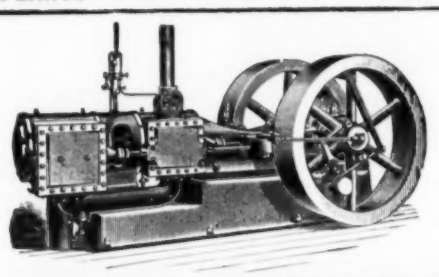

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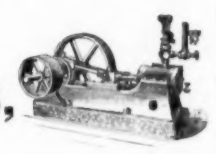

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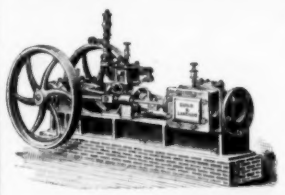

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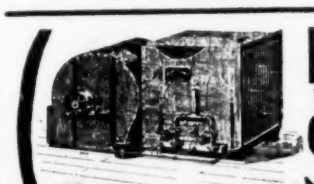

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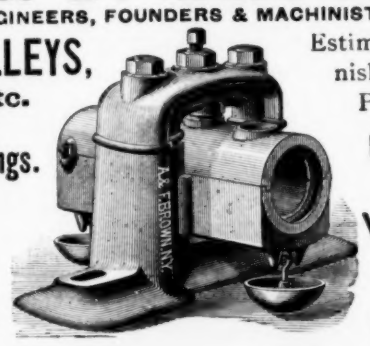

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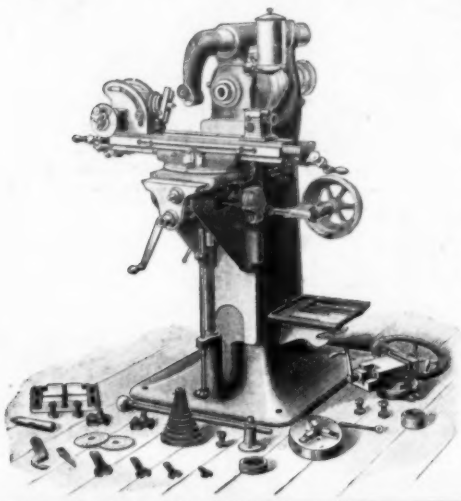

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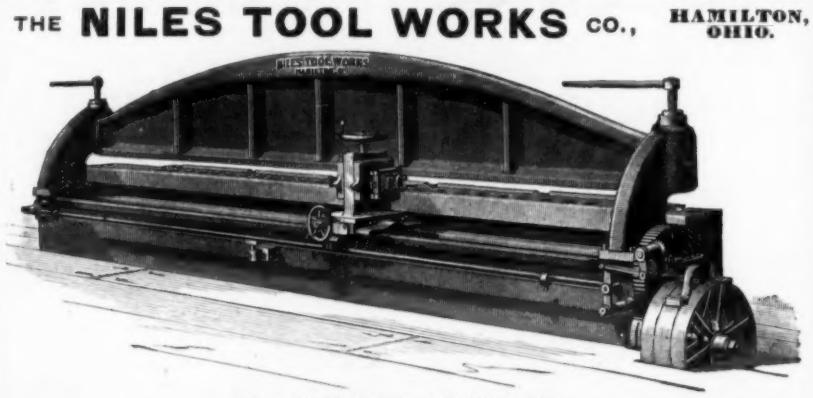

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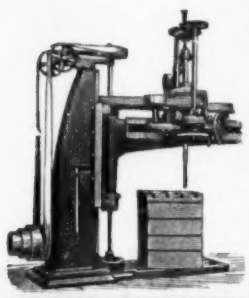

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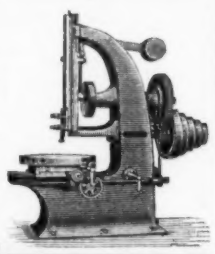

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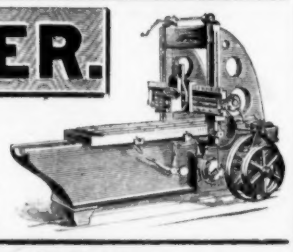

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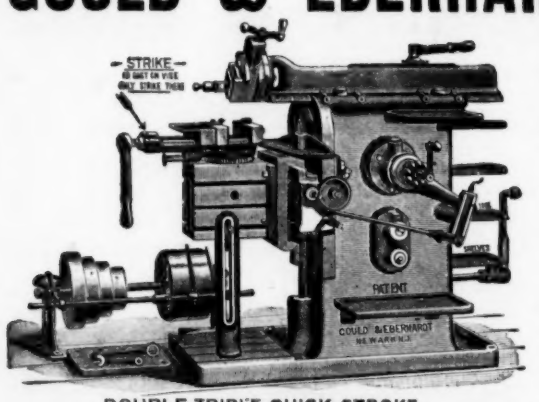

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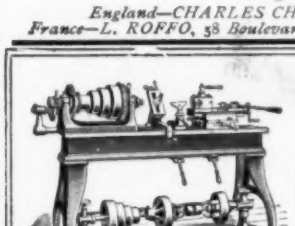

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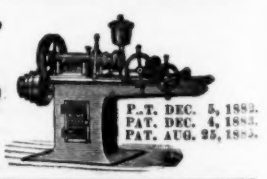

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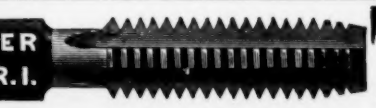

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